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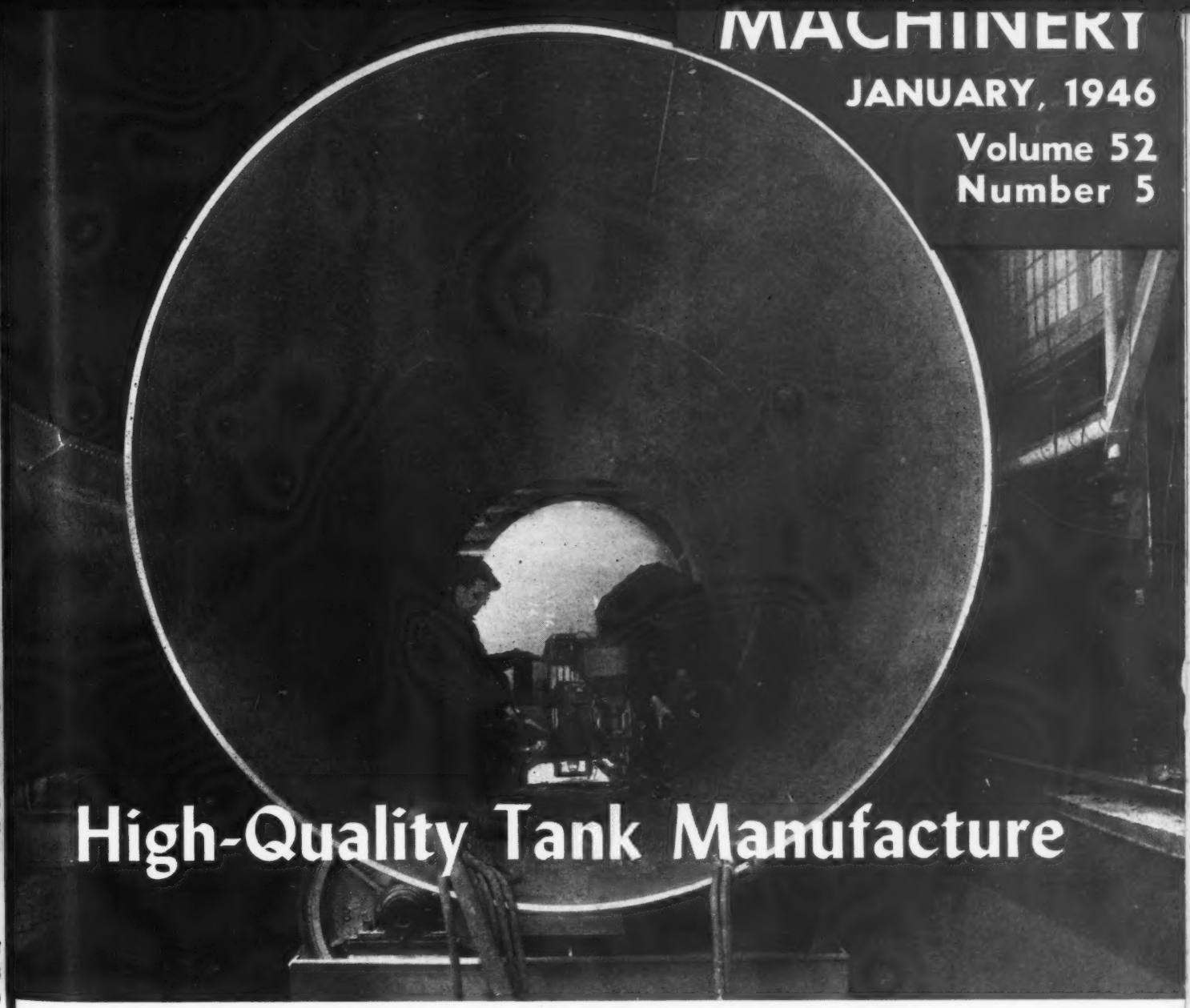

High-Quality Tank Manufacture

Large Tanks for the Transportation and Storage of Hazardous and Non-Hazardous Liquids and Gases are Manufactured on a Production Basis by a Technique that has Practically Eliminated Even Minute Welding Flaws

By WILLIAM P. HINDMAN
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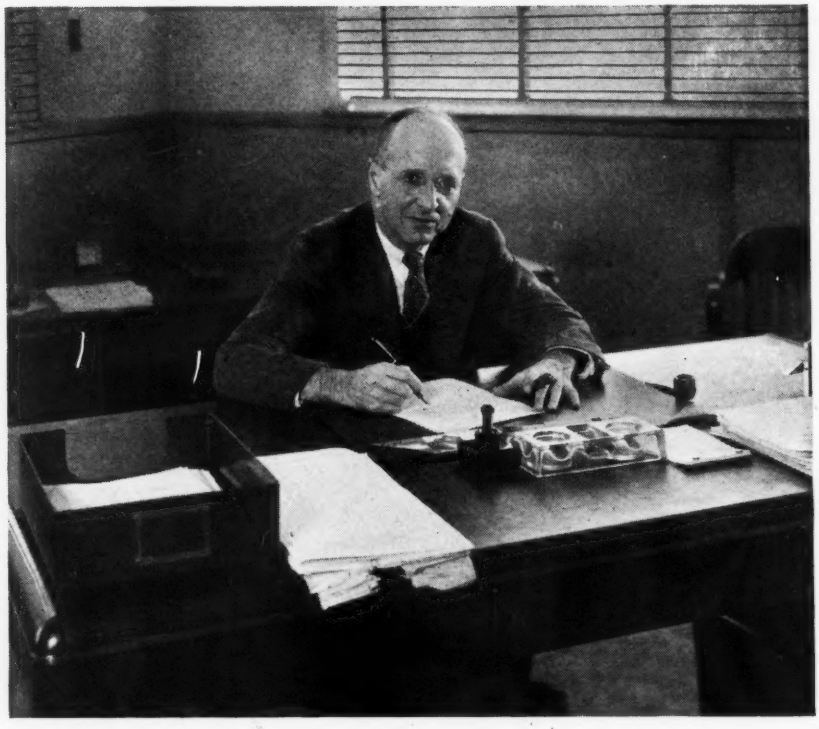
THE superiority of high-quality all-welded tanks over riveted designs has been recognized by the Interstate Commerce Commission and by many concerns who require these tanks for the transportation of liquids and gases. Today, tanks of all-welded fabrication are being widely used on railway tank cars, for storage purposes, in the processing of synthetic rubber and various other products, for bubble towers, and so on.

One of the outstanding advantages of all-welded tanks is their increased strength. For example, engineering specifications permit the calculation of the bursting strength of all-welded X-rayed and stress-relieved tanks to be based on a joint efficiency of 90 per cent, whereas with riveted tanks the strength of seams is calculated at only 70 per cent of the strength of the steel plate. As a matter of fact, the tensile strength, yield point, and ductil-



William P. Hindman, the author of this article, has been works manager of the Milton, Pa., plant of the American Car & Foundry Co. since 1927. He is a graduate engineer of the University of Michigan, class of 1916, and has been with the American Car & Foundry Co. since July 1, 1919. The interim between his graduation and his association with the American Car & Foundry Co. was spent in the United States Army during the period of World War I.

ity of X-ray quality welds in tank manufacture substantially exceed the equivalent physical properties in the parent metal. Another advantage of welded tanks is that they can be more readily lined with rubber or other materials than riveted tanks to meet the needs of the chemical industries.

The Milton, Pa., plant of the American Car & Foundry Co., which is devoted to tank and tank car manufacture, has been in the forefront in the advocacy of all-welded tanks and has developed a manufacturing technique that insures practically flawless tanks. Even though the welding is performed according to the Hartford Steam Boiler Inspection and Insurance Co.'s stringent interpretations of the code of the American Society of Mechanical Engineers, it is rarely necessary to cut out and reweld more than two defects on a large tank. Furthermore, the defects are usually minute flaws, and often no cut-outs are necessary. These statements hold true in spite of the fact that every inch of seam welding on a tank is X-rayed. More than one hundred X-ray photographs are usually made on each tank. Riveting is now a thing of the past at this plant, except for the export trade.

Most welded tanks are fabricated from A.S.T.M. No. A70-40 or A212-44 Grade B steel, but this concern recently built four large storage tanks from Type 430 (American Iron & Steel Institute) chromium steel. These tanks are believed to be the first ever fabricated from this material by the application of the Unionmelt submerged arc fusion welding process. They were each designed to hold 7800 gallons of 95 per cent nitric acid. They measured 78 inches in outside diameter and 31 feet in length, not including a 36-inch diameter by 20-inch high dome. About 275 feet of welding was performed on each tank.

Most I.C.C. tanks built in this plant are made of 11/16-inch thick plate, although plate thicknesses for code tanks run anywhere from 1/2 to over 2 inches. The largest tanks so far constructed were for a rotary kiln cement plant. Each tank was 300 feet long, and was 10 feet in diameter for approximately one-half the length and 11 feet in diameter for the remaining half. It was constructed of A.S.T.M. No. A70-40 steel plate, 29/32-inch thick, and weighed 300 tons.

Nickel-clad tanks have also been fabricated, tanks from Type 347 steel, and over one hundred medium-sized containers for carbon dioxide. These containers were produced from A212-44 steel having a tensile strength of 70,000 pounds per square inch. They were 31 inches inside diameter by 6 feet 2 1/2 inches high, and were made from 1 1/2-inch plates with 2-inch thick heads. These containers are used for developing carbon dioxide gas from dry ice, and must withstand an internal pressure of at least 1200 pounds per square inch.

The secret of successful tank welding by the technique developed in this plant lies in an exceptionally close control of the welding operations, which are performed automatically by the Unionmelt process.

Machining of the steel tank plates is performed on the Sellers double-housing plate planer seen in Fig. 1. This machine is constructed with a bed and overhead longitudinal rail along the front side, as seen in the illustration, and with a similar bed

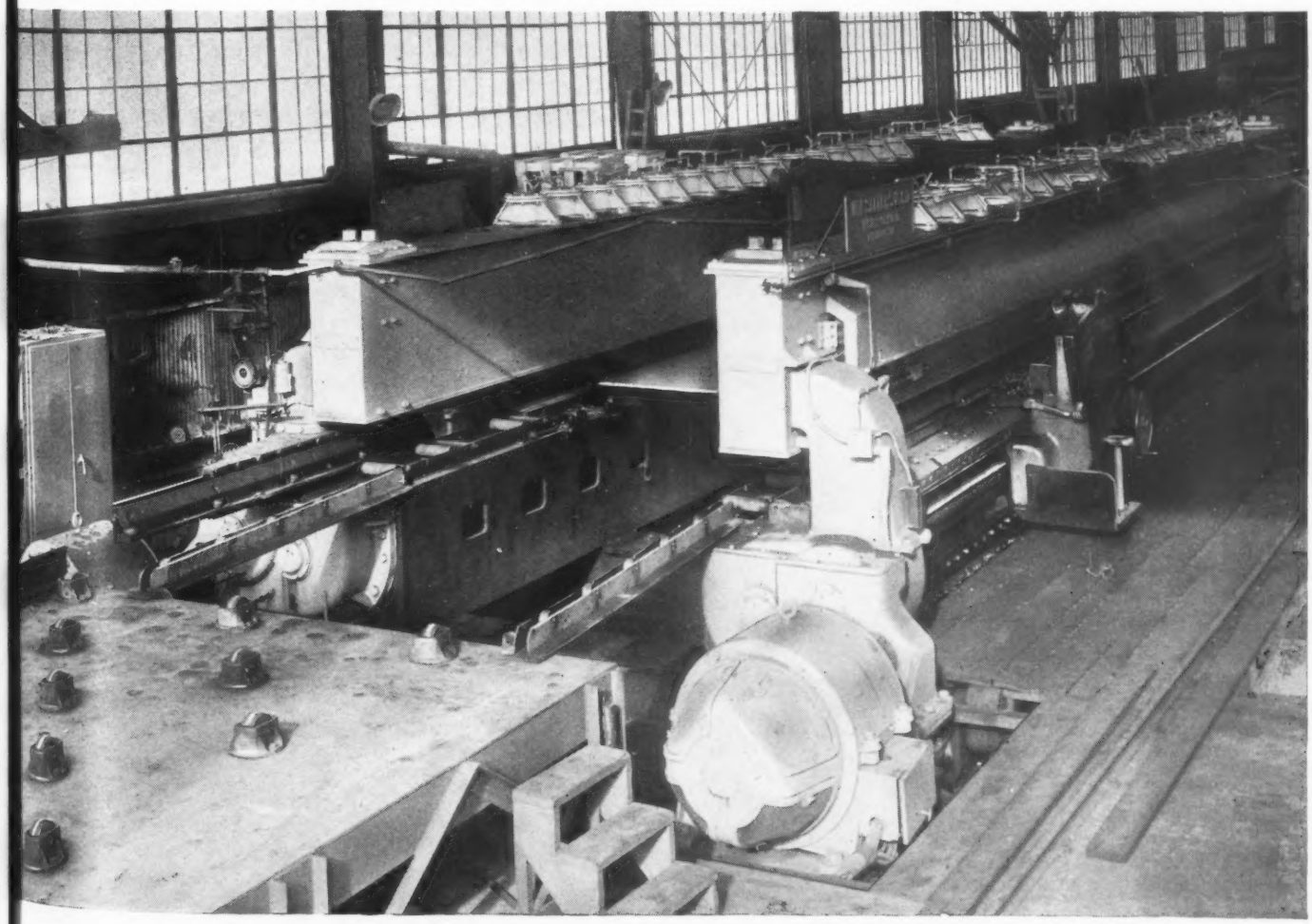
and rail along the rear side. The bed and entire housing on the front side are adjustable as a unit with respect to the rear unit, so as to provide for handling plates of different widths. Plates from a minimum width of 48 inches up to a maximum width of 163 inches can be handled. The machine accommodates plates up to about 40 feet in length, and weighs over 170 tons. A tool carriage such as seen in Fig. 2 is provided on each bed for machining the plate edges along their full length. These carriages can be operated simultaneously or singly, an operator being required for each carriage.

The plates are held securely to the two beds of the planer by means of clamps, each 4 feet long, which are actuated by pneumatic cylinders on the top rails of the planer. After a plate has been carefully set up and clamped, the opposite long edges are machined by the tools on the respective carriages. Fourteen or fifteen tools are usually provided on each carriage, arranged as illustrated in Fig. 3, which shows eight vertical tools for squaring up the flat "nose" on each edge, three vertical tools for cutting a bottom bevel along the plate, and three horizontal tools for cutting a top bevel. These beveled surfaces provide grooves, as seen at *A*, Fig. 4, for depositing welding electrode after the machined plate has been rolled into a cylinder. The bevels are made at different angles along the top and bottom of a plate so that grooves of identical included angles will be obtained on the rolled cylinder.

From three to four passes of each planer carriage are required to machine the edge of a plate within the specified tolerance. However, as many as eight passes may be needed in some instances. The amount of stock removed depends upon the excess stock, which is usually equal to the plate thickness. Roller tables at each end of the planer facilitate the loading and removal of the plates.

After the plates have been planed on all four edges, they are taken to bending rolls and rolled cold into cylinders, ready for welding. In the rolling operation, the plate is stretched a certain amount, and allowance must be made for this

Fig. 1. Double-edge Plate Planer Employed to Machine the Opposite Edges of Plates for Large Tanks Manufactured Under Closely Controlled Machining and Welding Procedures



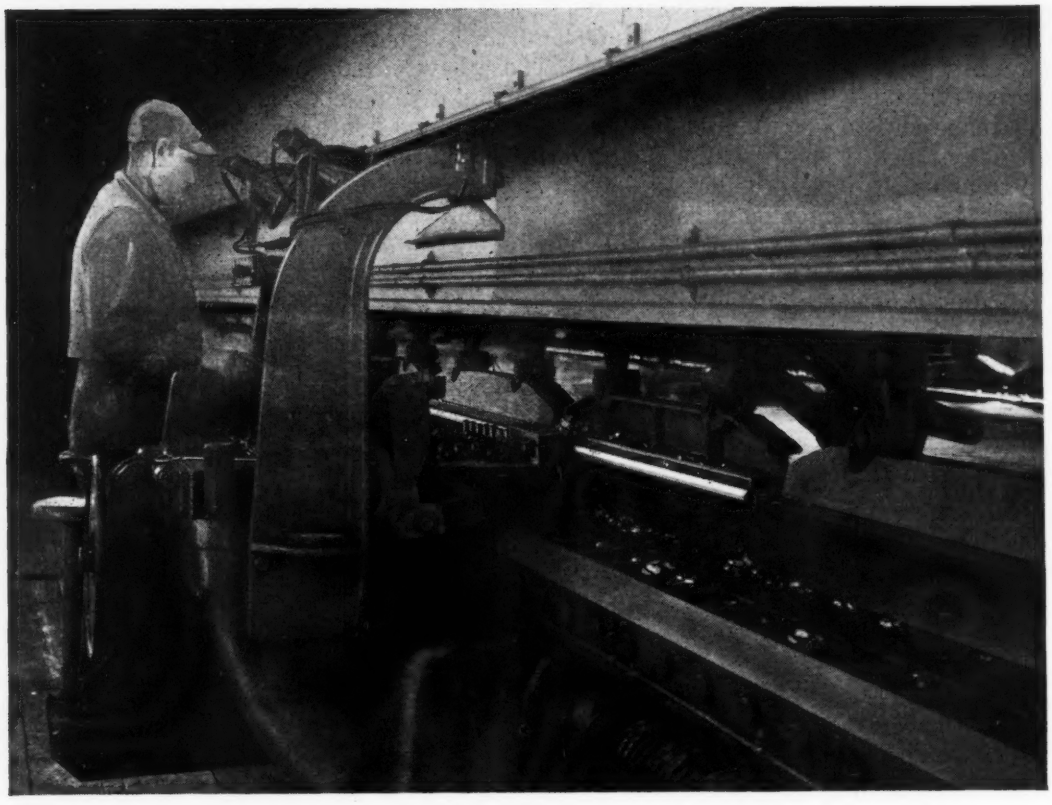


Fig. 2. Carriages on the Stationary and Adjustable Beds of the Double-edge Plate Planer Cut a Flat Nose and Two Bevels along Each Edge of the Plates to be Fabricated into Tanks

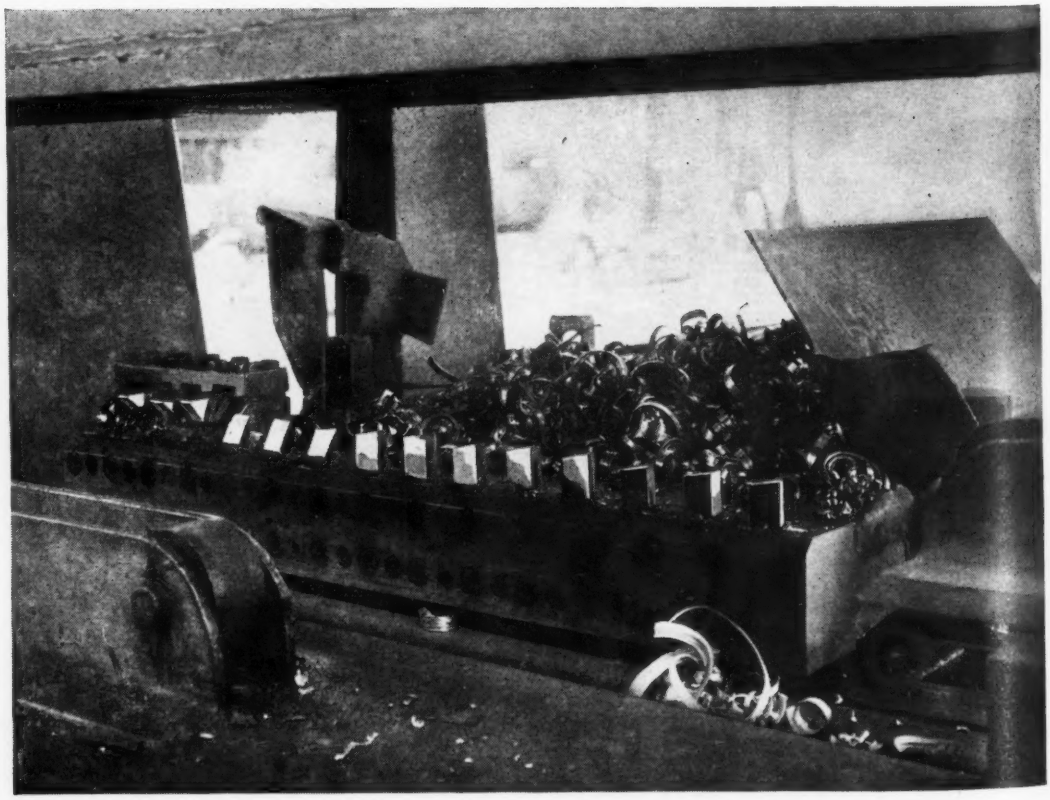


Fig. 3. Fourteen or Fifteen Tools on Each Planer Carriage, Arranged as Here Shown, Cut a Flat Nose and Two Bevels Simultaneously on the Edges of a Plate

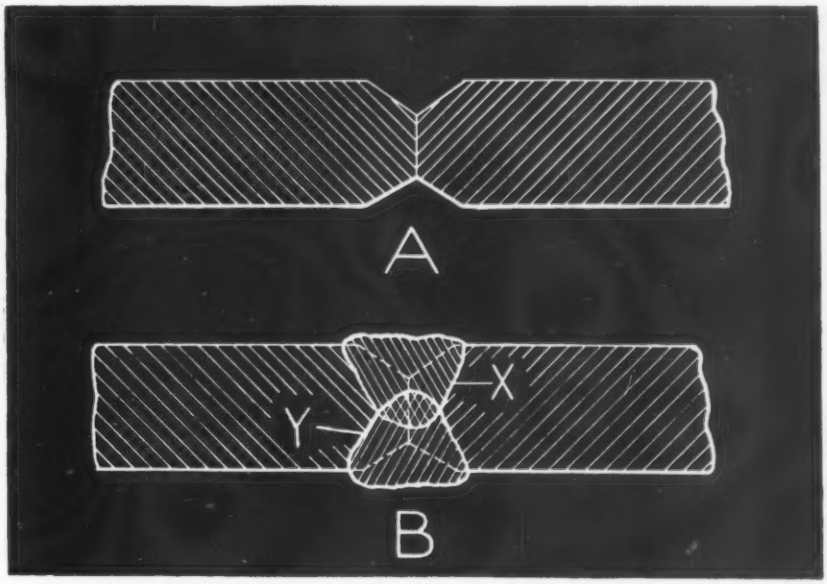
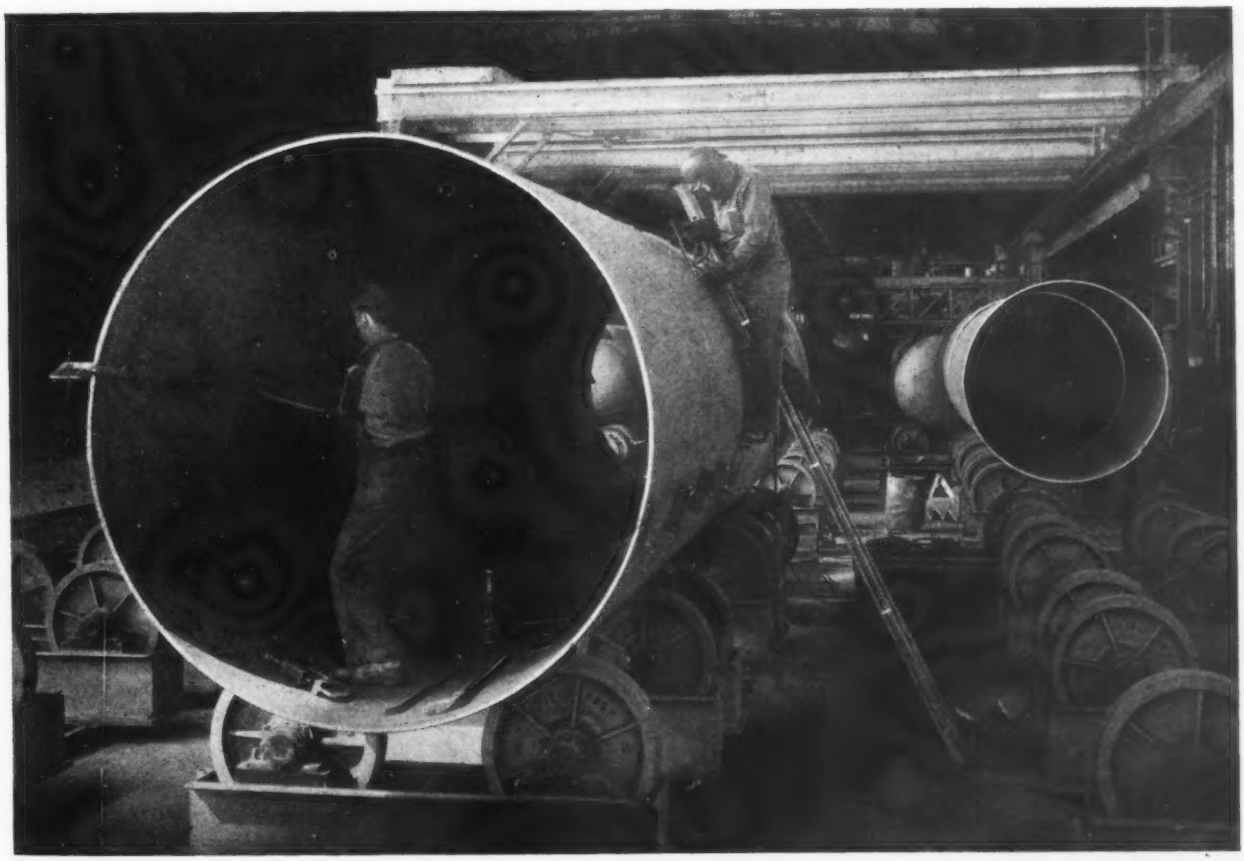


Fig. 4. (Right) Diagram (A) Shows the Proper Contact of Tank Seams to be Unionmelt Welded, and (B) the Procedure Followed in Welding the Plate from Both Sides

Fig. 5. (Below) The Tank Cylinders or Shells are Placed on Rotating Stands for the Seam Welding Operations, so that They can be Easily Revolved in Making the Circumferential Welds

stretch when the width of a plate is specified for a tank of given diameter.

After a plate has been rolled into a cylinder, it is transferred to a rotating stand, such as seen in Fig. 5, where the tank section is pulled into a true cylinder with the machined edges lined up. This is done by applying a jack on the inside, to hold the plate edges in line internally, and a cable on the outside which is tightened around the cylinder by means of a ratchet jack. When the cylinder has been thus set up correctly, angle-iron clips are tack-welded across the seam on the outside to hold the joint properly until it has been Unionmelt welded on the inside. Then the clips are cut off by means of an oxy-acetylene torch to permit welding the outside seam.



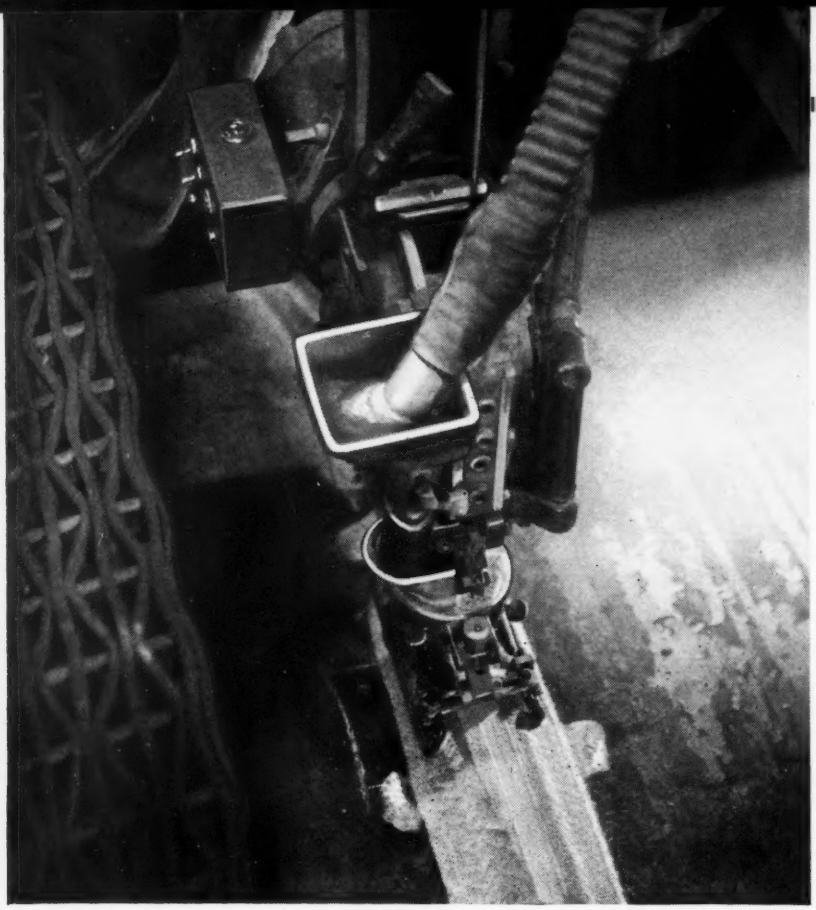


Fig. 6. Close-up View of a Unionmelt Welding Head in the Midst of a Circumferential Seam Welding Operation on the Outside of a Tank

Outside welding of longitudinal seams is performed by the use of a Unionmelt machine mounted on a gantry crane that runs along a track extending in back of several rotary stands. There are three of these gantry cranes. In welding circumferential seams, the gantry crane remains in one position and the tank section is revolved beneath the welding head. Fig. 6 shows a close-up view of the welding operation on a circumferential seam. Two sets of rollers in each rotating stand are motor driven through a speed reduction unit. The other rollers are idlers.

In welding on the inside of a tank, the welding head is mounted on a carriage or monitor, as seen in the heading illustration, which is automatically fed along longitudinal seams at a constant speed, being guided by a wheel that follows the groove in which electrode is being deposited. In welding internal circumferential seams, the same equipment is employed, but it remains in one position as the seam being welded revolves.

Welding is accomplished by a three-man gang. One man operates the welding machine, and the second man sucks up the excessive flux with a vacuum hose and knocks off flux that hardens over the weld. The third man is positioned on the inside of the tank when a seam is being welded on the outside and stands on the outside when the seam is being welded on the inside. This man judges the amount of penetration from the color of the plate on his side of the tank, and signals the operator by hammer blows on the tank when the color shows that the heat penetration is insufficient or too great.

Successful welding requires a proper balance between type of flux, arc travel speed, and the voltage and amperage of the electric current employed. Each welding machine operator is given a card that specifies the technique he must employ for the job on hand, and he must adhere strictly to instructions. However, he may be permitted to vary the current as much as 100 amperes.

In the first pass along a seam, the attempt is made to weld as far down into the nose of the

Fig. 7. Heads for Welded Tanks are Pressed from Steel Plate by Applying the 1100-ton Hydraulic Press Here Shown. This Illustration Shows the Press at the Beginning of an Operation

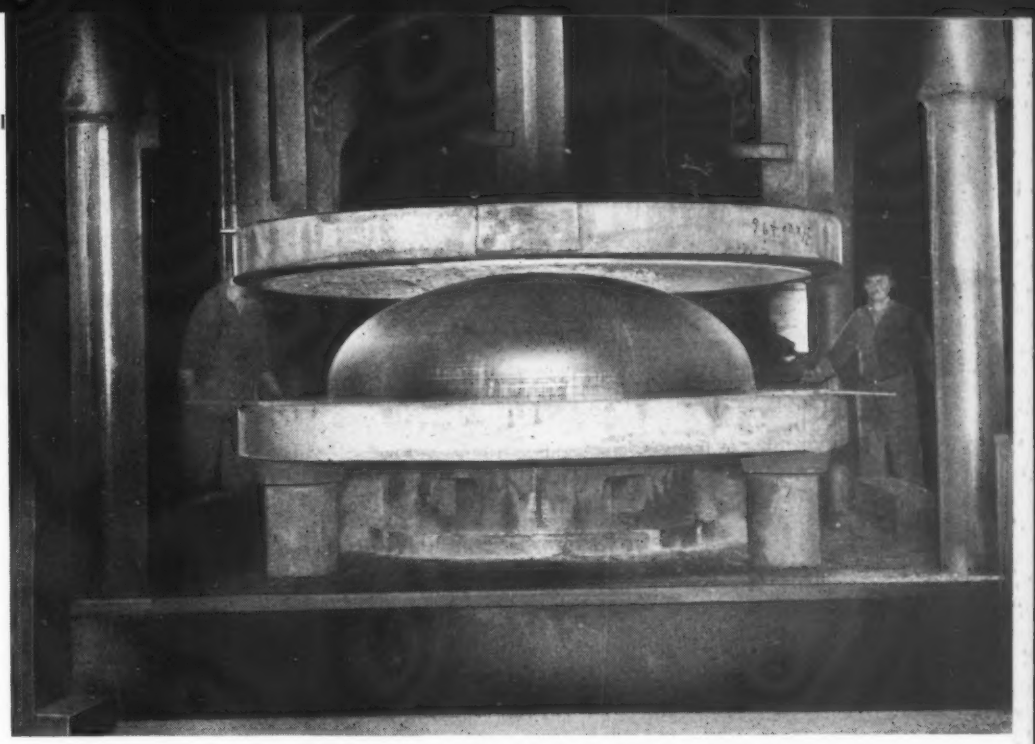


Fig. 8. In Forming the Tank Heads, the Hot Steel Plate is First Gripped between a Large Blank-holder and a Ring Die, and then Forced through the Die by the Rising Punch, as Shown

plates as possible without burning through the nose. The depth of the first weld is indicated by line *X* in diagram *B*, Fig. 4. In making the second pass on the opposite side of the plates, the welded metal of the first pass is overlapped, as indicated by line *Y*. This technique insures good welds, without gas pockets or other defects. The welded metal is fine-grained and possesses higher ductility, yield point, and tensile strength than the parent metal. On all pull tests on specimens welded by this practice, the parent metal tears while the weld does not. It should be stressed again that the width of the plate nose and the angles and depths of the grooves are of prime importance to satisfactory welding.

The same care that is taken in machining the plate edges for the cylindrical sections of tanks is observed in preparing the heads for welding. These heads are produced from flat plates by the 1100-ton hydraulic press seen in Fig. 7. Plates to be pressed are first heated to 1875 degrees F. and quickly transferred from the furnace into position over the male die, as shown. Then the entire platen and male die are raised until the plate is gripped between a large circular blank-holder and the ring die above it. With the plate securely clamped, the male die keeps rising and pushes the plate through the ring die until it attains the desired shape, as shown in Fig. 8.

By this method, heads of accurate shape, with uniform dimensions, are produced, and the operation is performed with minimum distortion of the metal. The flanged end of the head is then cut off with an oxy-acetylene torch, to remove most of the excess stock. The head is then transferred to a boring mill for facing and beveling the flanged end to suit the correspondingly prepared nose on the end of the tank section to which the head will be welded. The head seen in Figs. 7 and 8 has an

Fig. 9. The Unionmelt Welding Process is Employed in Welding to Fill Any Cut-outs that may be Necessitated by Defects that are Occasionally Encountered in the Welded Tank Cylinders

Fig. 10. Every Inch of Weld on Tanks Built by the American Car & Foundry Co. is X-rayed to Guard against Flaws

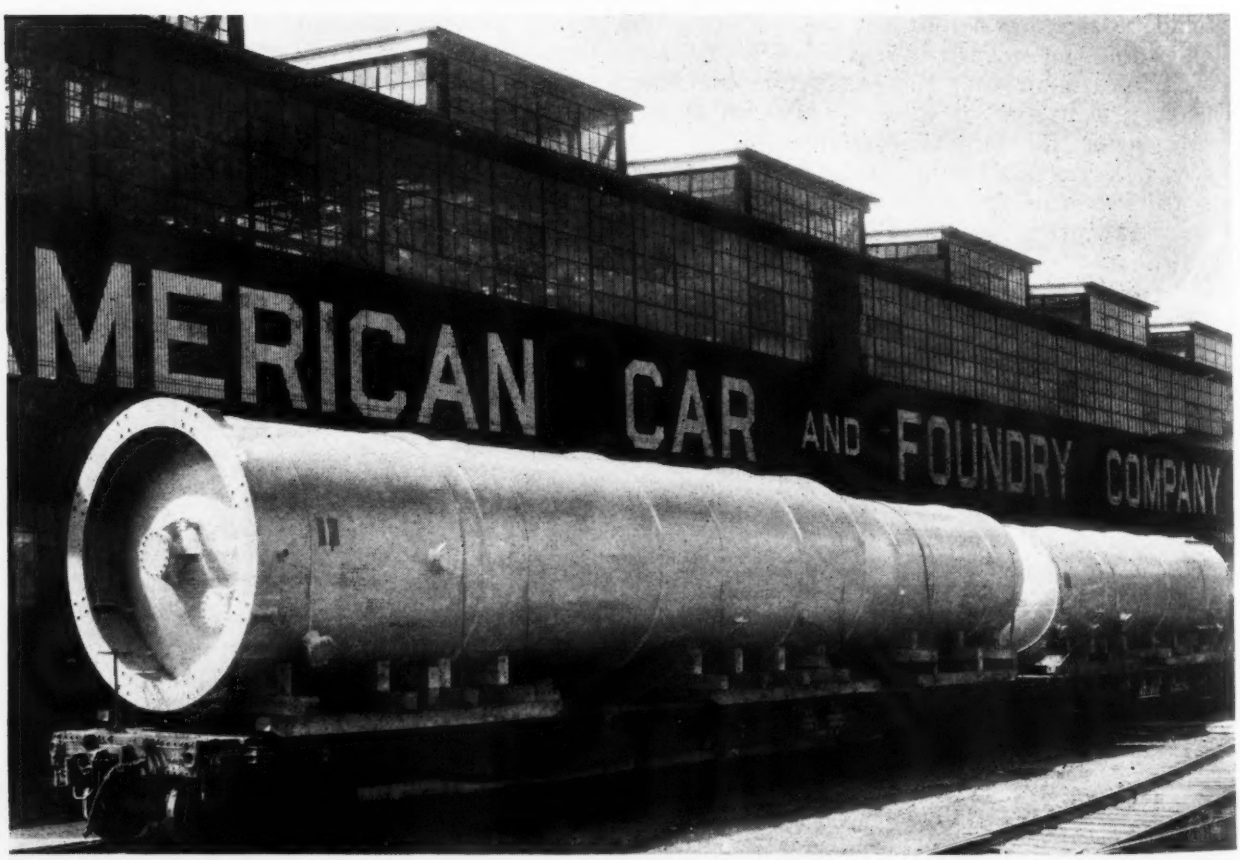
inside diameter of 103 inches, and was drawn to a depth of about 3 feet. The circular blank from which the head was produced measured 130 inches in diameter.

On compartment tanks, it is necessary to weld plugs through holes in opposing flanges in order to tie the compartments together. For this operation, a Unionmelt welding machine designed especially for plug welding is employed. Unionmelt welding is also applied by the use of a hand torch to fill in cut-outs that may be necessary because of any possible weld defects. Such a hand operation is in progress in Fig. 9.

All tanks are stress-relieved in furnaces, and every inch of welded seam is X-rayed, as already mentioned. Fig. 10 shows a close-up of a typical X-raying operation. Each negative is numbered, so that the photograph for any particular area of a tank can be quickly located. Complete X-ray records of all tanks are filed for future reference.

Specifications prescribe that the completely fabricated ASME-U-69 and I.C.C. tanks be hammer-tested while under hydrostatic pressure, in addition to being subjected to the hydrostatic pressure tests. No tank welded in this plant has ever failed to pass these tests. Positive proof of satisfactory welds obtained by X-raying precludes failures.

Fig. 11. Bubble Tower Fabricated Completely by Unionmelt Welding. The Complete Tower Measures 107 Feet in Height and has a Maximum Diameter of 120 Inches



New Crush-Dressing Applications

The Practice of Wheel Crushing for Dressing Grinding Wheels for Different Types of Form-Grinding has Become an Important Process during Recent Years. New Applications are Constantly being Developed. Some of These New Developments are Described in the Following Article

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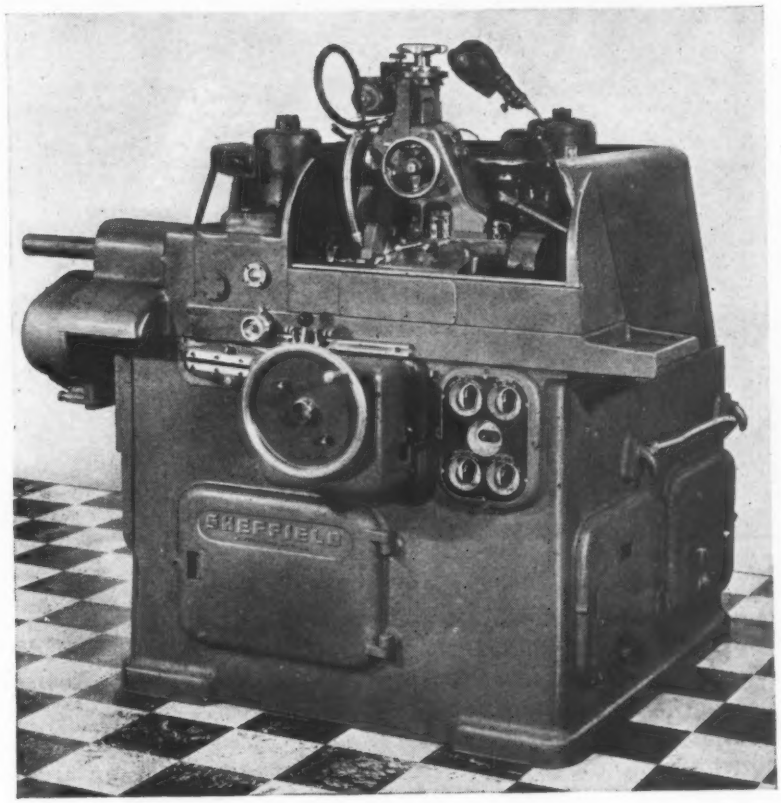


Fig. 1. Sheffield Precision Thread- and Form-grinder Used for Plunge or Traverse Thread-grinding or for Reproduction of Forms such as Working Crusher Rolls from Master Crusher Rolls

MANY new and unusual applications of crush-dressing of grinding wheels have been developed since the first American thread- and form-grinder using crushing as a means of wheel dressing was built in 1941. The horizon is constantly being widened as industry becomes more and more aware of the great possibilities of crush-dressing—a process by means of which grinding wheels are shaped or formed by a metallic roll having the contour desired in the ground work. The form of the roll is impressed into the wheel by a pressing or crushing action, the grains of the wheel being broken away from their bond by rolling the crusher against the wheel under pressure.

A grinding machine employing the crushing method of dressing should be designed from its base up with this dressing method in mind. The spindle must be especially rigid at both crushing and grinding speeds. The crusher mounting obviously needs to be very rigid to withstand the radial thrust, and a positive drive is required to withstand the high torque of wide-face cuts.

The process of wheel crushing is well exemplified in the Sheffield precision thread- and form-grinder shown in Fig. 1. First the crusher-roll housing is lowered to the point where the crusher roll engages the wheel, which is at rest. Coolant is then directed to the crusher-roll housing. The operator now closes a switch and the wheel starts revolving at the crushing speed of 80 R.P.M. At the same time, the crusher roll is fed into the wheel by means of a motor coupled to the micrometer in-feed screw. A dial on the screw, calibrated in half-thousandths inch, tells the operator when full depth has been reached. At this point, the crusher in-feed is stopped and the wheel brought to rest. The wheel is now ready for the grinding operation. The entire crushing cycle requires from two to three minutes.

Crush-dressing can also be applied to surface grinders in any one of three ways. The simplest method for tool-room work is by means of an idler type fixture mounted on the table of the grinder, as shown in Fig. 2. The fixture holds a precision arbor, mounted on anti-friction bearings, on which is placed a crusher roll. In dressing, the table of the surface grinder is moved beneath the wheel. While the wheel is stationary, it is lowered into

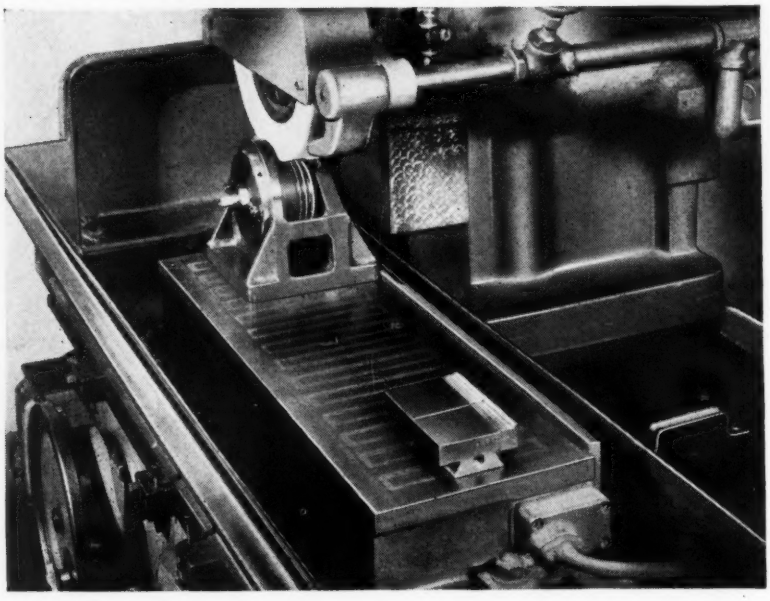


Fig. 2. Crush-dressing on a Surface Grinder by Using an Idler Type Fixture on the Table of the Grinding Machine

contact with the roll so that the wheel and roll just engage; the coolant is then turned on, and the wheel revolved at crushing speed by means of a hand-crank (not shown), which fits into the wheel flange. While the wheel is being rotated, it is slowly fed to the proper depth and allowed to make several turns after the depth is reached, in order to clean up the wheel form. After the dressing operation, the crank is removed, the wheel guard replaced, and the wheel is ready for grinding.

When it is not practicable or possible to have the wheel revolve the crusher at crushing speed (250 to 300 surface feet per minute), the roll may be power-driven to rotate the wheel. Such an arrangement is shown in Fig. 3. A motor drives the crusher roll at a reduced speed by means of reduction gears. The cycle of crushing is the same as that when the hand-crank is used to turn the wheel, except that in this case the crusher roll rotates the wheel through frictional contact instead of the wheel's rotating the crusher.

The most desirable method of crush-dressing a wheel in a surface grinder is to have the crushing device mounted on the wheel-head slide with the wheel and roll always in accurate relation to each other. This leaves the entire table free for the work to be ground. It also keeps the dressing mechanism out of the path of coolant and grinding chips and grits. This type of dresser is illustrated in Fig. 4.

In order to eliminate the human element as much as possible, the crusher roll has a power in-feed, so that the rate of dressing is uniform. Also, the wheel is turned at crushing speed by means of a geared-head motor directly coupled to the wheel-spindle and driving it through an over-running clutch. On a grinder so equipped, the full benefits of crush-dressing are being applied to the rapid production of flat form tools, lamination dies, rolled thread dies, and other work of varied and precise profile.

At this point, it is of interest to compare what happens to a wheel when it is diamond-dressed and when it is crush-dressed. Fig. 5 shows the magnified grits of a 220-grit wheel, tied to each other by their bond. In diamond dressing, the diamond, being harder than either grit or bond, cuts away both. This results in flat grits that are likely to cause friction and heat, which, in turn, may soften the material to be ground.

When the wheel is crushed, the grits are broken and loosen from their bond, as illustrated in Fig. 6. All the remaining grains retain their original sharp cutting edges and there is room for coolant and space for chips. These photomicrographs illustrate one of the advantages of the crush-dressed wheel, which provides a better cutting surface with many more sharp cutting points and without dull flats. Other advantages claimed are:

1. The number of pieces that can be ground per dressing is remarkably increased. The reason is obvious; more shaves are possible with a good sharp razor blade than with a dull one.

2. On the most varied profiles, crush-dressing forms the wheel to the desired shape in a fraction of the time possible by any previous conventional dressing method.

3. The cost of dressing wheels is greatly reduced, not only because of the number of pieces ground per dressing, but because of the large number of dressings possible with a crusher roll. Experience indicates that from five to twenty times more stock can be removed in a given period of time with crush-dressing than with diamond dressing.

4. Longer wheel life is obtained by crush-dressing because it is only necessary to remove the dull

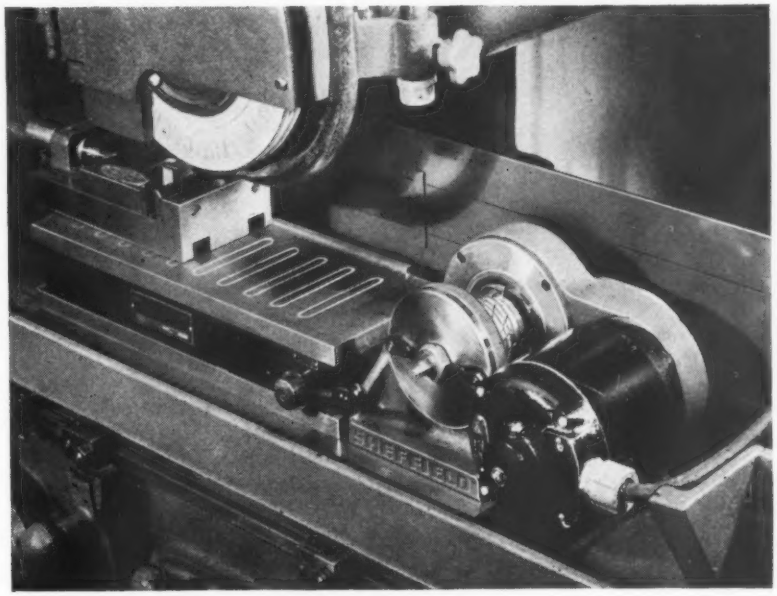


Fig. 3. Small Motor Employed to Drive the Crusher Roll at Reduced Speed by Means of Reduction Gears

grits. The dressing operation itself does not tend to dull the grits.

5. Crush-dressing allows closer grinding of work because the hazard of burning is reduced and less pressure is necessary to remove stock.

The Making of Master Crusher Rolls

In making the master crusher roll, the process is exactly the same as that used in making circular form tools. A machine—the Sheffield Micro-form grinder (Fig. 7)—has been developed to enable relatively unskilled workers to produce crushers to an accuracy as close as 0.0003 inch in less time than with universal grinders requiring greater operator skill. Many plants throughout the country are now using this machine on crusher-roll work, as well as for producing precision profiles on either flat or circular work. Working crushers can be made by using the master crusher to dress the wheel of a cylindrical grinder and then grinding duplicate crushers to the correct form.

Grinding Wheels Suitable for Crush-Dressing

While both silicon-carbide and aluminum-oxide wheels can be crush-dressed, the essential element is the bond, because it is the breaking of the bond

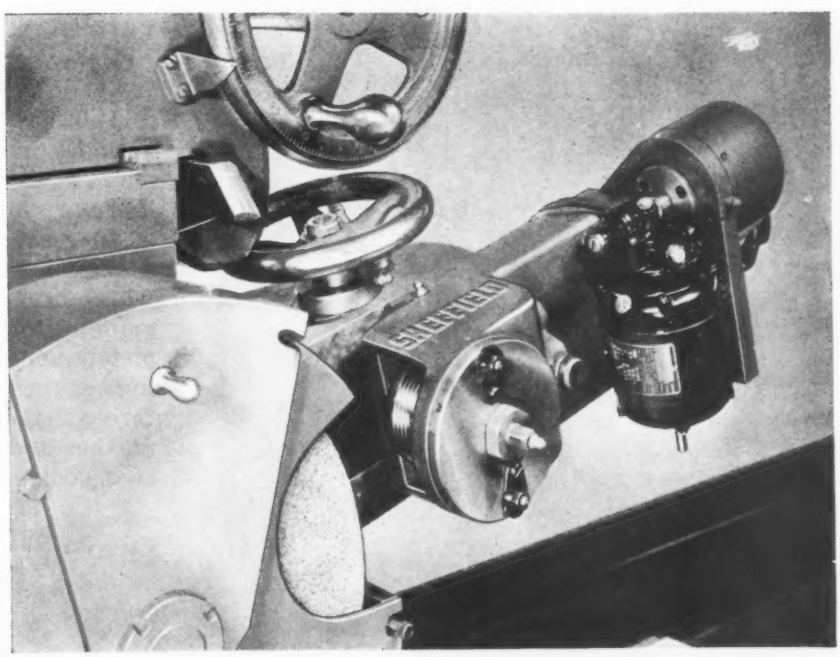


Fig. 4. Turning the Wheel at Crushing Speed by Means of a Geared-head Motor Directly Coupled to the Wheel-spindle, and Providing an In-feed for the Crusher Roll by Another Motor

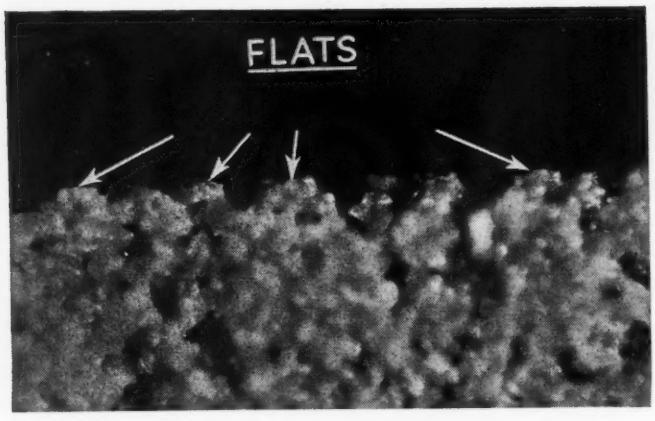


Fig. 5. Greatly Magnified Grits of a 220-grit Wheel Dressed with a Diamond

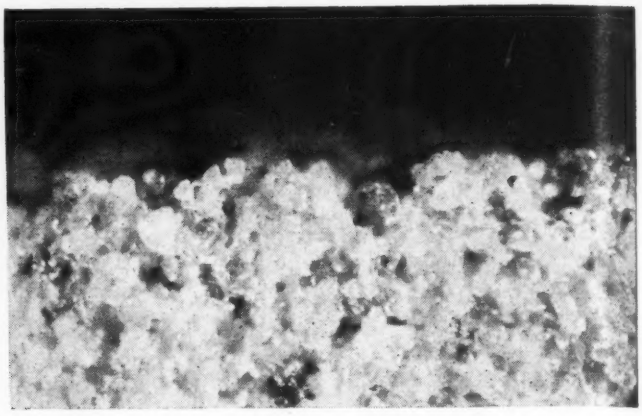


Fig. 6. Greatly Magnified Grits of a Crush-dressed Wheel of the Same Grit

linking the grains that makes the process practicable. Vitrified bond wheels seem best suited to crush-dressing because of the easily fractured nature of the bond. Approximately 75 per cent of all grinding wheels have this kind of bond, which is unaffected by water, acids, oils, or ordinary temperature conditions.

The grade of a wheel is a measure of the holding power of the bond. Medium grades J to P are easily crush-dressed; they also remove stock rapidly. The grain and grit size is determined by the shape of the contour to be ground and the finish required. For example a 220-grit wheel has grits of approximately 0.004 to 0.005 inch in the largest dimension; thus the sharpest possible root in a thread ground with such a crush-dressed wheel would be a fillet of from 0.004 to 0.005 inch. Wheels of from 46 to 440 grit are now being crush-dressed satisfactorily.

Fig. 7. Sheffield Micro-form Grinder for Producing Master Crushers to Close Limits of Accuracy

Materials for Crusher Rolls

What material is best for making crusher rolls? This is one of the most frequently asked questions. Considerable experimentation has been carried out with various steel alloys and carbides, and this work is continuing. Up to the present time, high-speed steel has been found the most economical, based on the cost of material, time of grinding it to shape, and the life of the crusher roll, in terms of finished parts.

Coolants for Crush-Dressing Grinding Wheels

Another common question concerns the use of coolants or whether crushing should be done dry or wet. Many forms can be crushed dry, provided there are means for getting rid of the grits as fast as they are broken from their bond. Some forms are of such a character that dry crushing will cause wheel breakage at the edges. By using thread-grinding oils as a coolant, wheel chipping is completely avoided. The oil-soaked wheel, after crushing, can be spun dry; and the centrifugal action forces the oil to flush out any embedded grit. Finer finishes and closer tolerances are obtained with oil as a coolant or lubricant during crushing.

In full form-grinding—either flat or cylindrical—the surface of the wheel determines the surface finish of the work. For fine finishes, finer grades of wheels must be used. A 220-grit crush-dressed wheel on hardened 4615 steel can be made to produce a 10 micro-inch finish on cylindrical work.

Plunge and Traverse Thread-Grinding and Form-Grinding

Before proceeding with an examination of work produced by crush-dressing, a brief reference to plunge and traverse thread-grinding and form-grinding will be made. In Fig. 9 is indicated a wheel with a 1-inch face, crush-dressed to proper thread form, with sixteen threads to the inch. Below the wheel is indicated a piece of work on which a 1-inch length is to be provided with ground threads, sixteen to the inch. By allowing one-half revolution of the work for bringing the wheel to depth and then adding one full revolution, sixteen threads per inch for a length of 1 inch will be ground. This is called "plunge thread-grinding." It is a process exactly like hobbing, except that in this case the grinding wheel acts as the hob.

Traverse or pass-over thread-grinding with a multi-ribbed crush-dressed wheel is used when the length of thread to be ground exceeds the wheel width. Each groove on the wheel takes its share of the load. The first rib to engage the work takes a cut; the second rib takes off a little more stock; and the trailing ribs clean up the thread in much the same manner as a broach acts in producing a hole. Rarely is it necessary to make more than one pass in multi-ribbed traverse thread-grinding.

In form-grinding, the work does not travel, but revolves in a fixed location with respect to the wheel. The wheel is fed to depth, the time required being dependent upon the hardness of the material and the volume of stock to be removed.

Examples of Work Ground with Crush-Dressed Wheels

Some of the most recent results of crush-dressing as applied to both straight-line and circular form-grinding are of considerable interest in revealing the steady and rapid expansion of what can be done by the use of this method. Fig. 8 illustrates a successful application of crush wheel-dressing to straight-line form-grinding. The finished part is made of high-speed steel with a hardness of from 66 to 67 Rockwell C. A cross-section of the form to be ground on the part is indicated, with dimensions and tolerances. Because of the

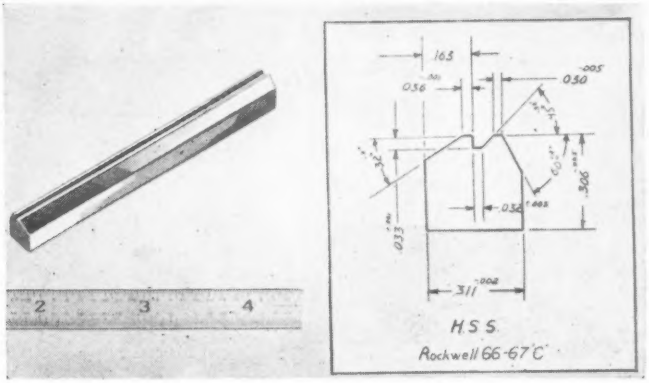


Fig. 8. Form Produced on a Straight Part with a Crush-dressed Wheel

perpendicular surface in the center (at the 0.032-inch dimension), the work is inclined during grinding at a 4-degree angle with respect to the wheel-spindle. The crusher roll is made to compensate for this.

A 220-grit wheel was dressed with a standard Sheffield idler type crushing device which was revolved by hand with a crank inserted in the wheel flange. Socony No. 269 coolant was used for both crushing and grinding. Ten of these tools were rough-ground from the solid to within 0.003 inch of the required depth. The wheel was then redressed in approximately 3 minutes and the ten parts were finish-ground to the required dimen-

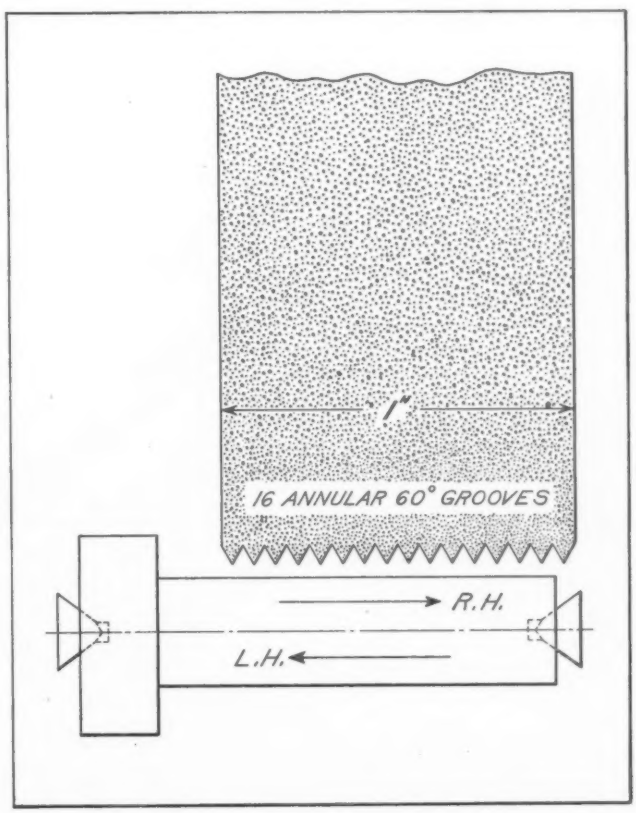
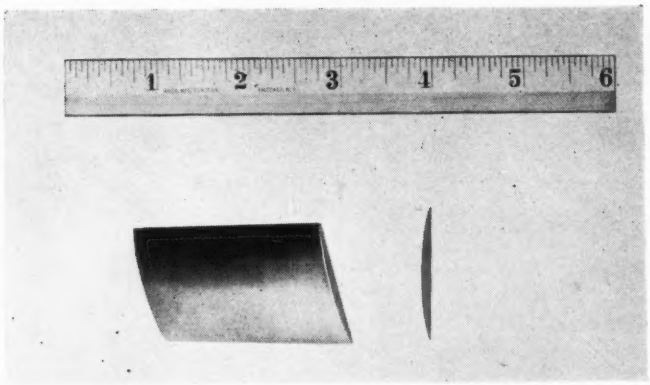


Fig. 9. Plunge-grinding a Threaded Section 1 Inch Long, with a Crush-dressed Grinding Wheel



sions. The rough-grinding operation required 5 minutes and the finish-grinding 2 minutes, making the total grinding time per part 7 minutes. Had the work been ground on a surface grinder with table capacity sufficient to hold ten tools, the time could have been considerably reduced. Even so, this is an excellent example of the time savings possible in grinding a rather complicated form.

The vane shown in Fig. 10 is 3 inches long and 1 3/8 inches wide, with a maximum thickness of 0.126 inch. Sixteen chordal dimensions on each side of the section center line, or a total of thirty-two dimensions, are held to a tolerance of plus or minus 0.0005 inch. This part was ground from a solid hardened rectangular blank by a grinding wheel with a 1 1/2-inch face, dressed to form the full 1 3/8-inch width of the vane at one time. The vanes were held magnetically for grinding both sides. For grinding the flat side, the vane was nested in a magnetic parallel which had been similarly formed with a crush-dressed wheel.

The operation sequence in the grinding of this part is as follows:

1. Make three crushers on a Micro-form grinder: (a) one convex for the curved side of the vane; (b) one convex for the slightly curved opposite side of the vane; and (c) one concave to provide for nesting the first side in the magnetic parallel.
2. Crush-dress with (a) and grind the part on a standard magnetic chuck.
3. Crush-dress with (c) and grind the magnetic parallel.
4. Crush-dress with (b) and grind the second side of the vane as it is held in the magnetic parallel.

The grinding time of 20 minutes is not truly representative of the possibilities on such work, since the wheel-crushing was done with hand-cranking on a 6- by 18-inch, 1-H.P. grinder, using a 7-inch wheel. On a larger machine, with more rigidity for crushing and more power for grinding, this part could be held to closer limits and ground in a fraction of the time.

Grinding Thread-Rolling Dies and Chasers

The flat thread-rolling dies shown in Fig. 11 have been ground from the solid hardened blank using a full-face wheel on which the thread form has been crush-dressed by the crusher roll shown. The form of thread on the crusher roll must be calculated, as well as the lead spacing, since the grooves in the die must produce the correct lead

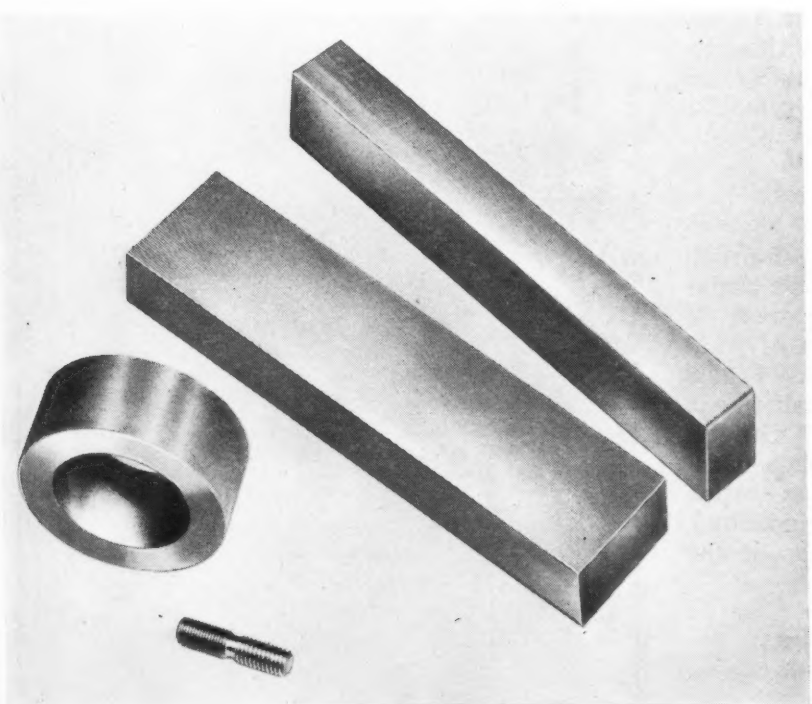


Fig. 10. (Above) Vane Accurately Form-ground with a Crush-dressed Wheel

Fig. 11. (Left) Thread-rolling Dies Ground with Crush-dressed Wheels. The Fine Threads on the Crusher Roll and Flat Dies are Barely Visible in the Illustration

and thread angle at the required helix angle of the part to be rolled. Obviously, this method of producing flat thread-rolling dies is many times more rapid than conventional methods.

The grinding of chaser type inserts for collapsing taps is an interesting application. This grinding is performed with crush-dressed multi-form wheels. The chasers or inserts were mounted on the arbor illustrated in Fig. 12, which holds them in a position similar to that which they occupy when assembled in the tap. The threads are plunge-ground with a multi-ribbed crush-dressed wheel. The pitch diameter tolerance is 0.0008 inch and the concentricity tolerance is 0.0002 inch, the angle and lead being maintained within predetermined gage limits. The finished inserts were produced in a thread-grinding time of 10 minutes per set ground from the solid. The grinding time on a job of this kind, with wide interrupted cuts is, necessarily, as long as the grinding time for a continuous thread of the same diameter.

Grinding Worms with Whitworth Thread Form

Fig. 13 shows a worm with three and one-half threads per inch. This worm has a modified Whitworth thread form which has been finish-ground over the full form, using a multi-form crush wheel. The part is finish-ground from a heat-treated prethreaded blank of S A E 4140 steel, hardened to from 30 to 33 Rockwell C. About 0.030 inch of stock remains on the pitch diameter of the thread as the part reaches finish-grinding.

A 1 1/4-inch wheel face is crush-formed with four ribs on its face, two of the ribs being of the finished form dimensions and the two other, or leading, ribs of slightly smaller form for progressive stock removal in traverse grinding. The two leading ribs of the grinding wheel are engaged in the first two ribs of the work at the beginning of the automatic traverse grinding cycle, and the face of the wheel travels the full length of the part. A tolerance of 0.001 inch is maintained on the pitch diameter, and limits of plus or minus 0.002 inch on the outside diameter.

A study of the forming roll in Fig. 14 indicates that the conventional method of grinding this part would take six operations on a universal cylindrical grinder. The first two operations would consist of grinding the angles on both sides; the third and fourth operations would grind the 1/64-inch radii; in the fifth operation, the outside would be ground;

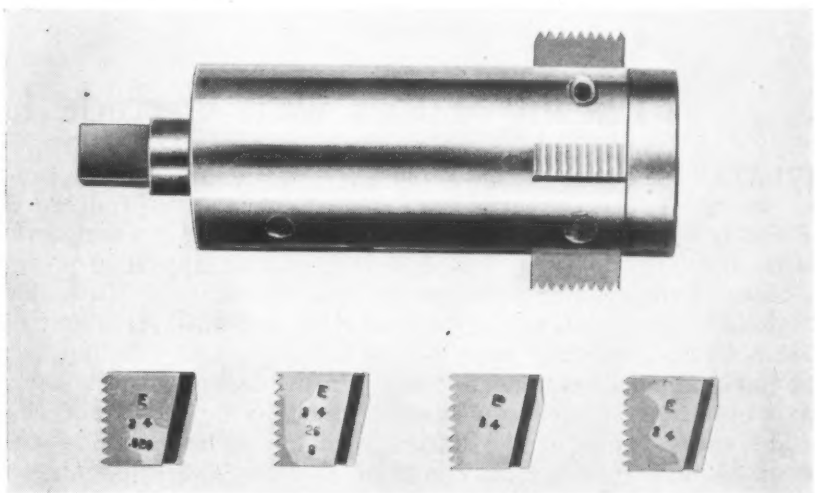


Fig. 12. Example of Thread Chasers Ground with Crush-dressed Wheels

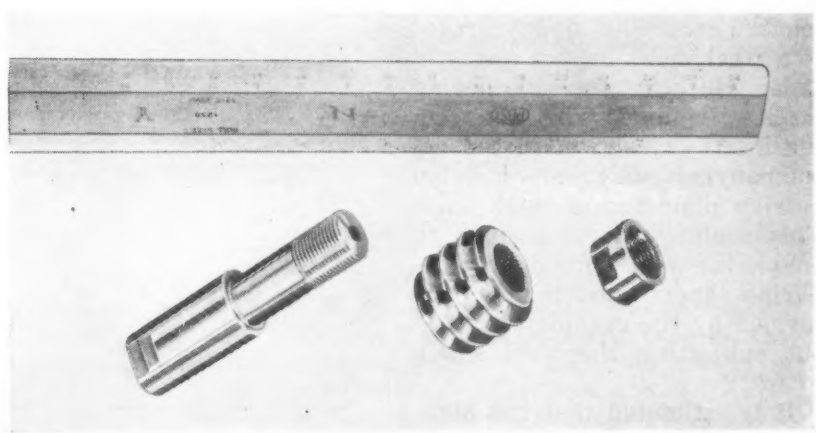
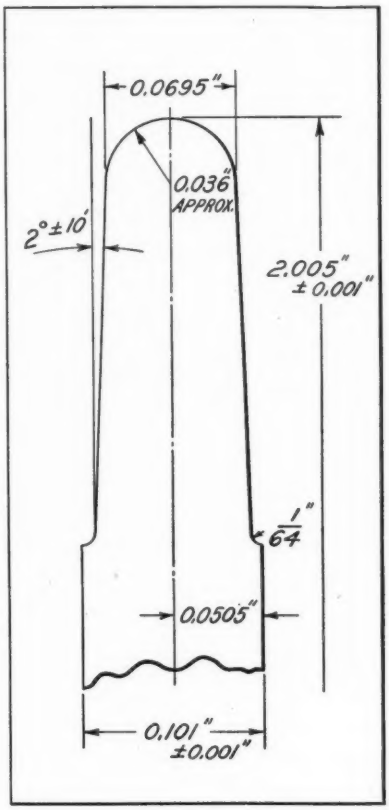


Fig. 13. Whitworth Thread Forms that have been Ground with Multi-ribbed Crush-dressed Wheels

Fig. 14. Example of Form-grinding at the Rate of Sixty Parts per Hour with a Triple Form-grinding Wheel



and in the sixth operation, the outside would be rounded to the 0.036-inch radius.

Compare this with the crush-dressing method for forming the wheel to the desired profile and duplicating this profile three times on the wheel. Three forming rolls are ground simultaneously from the solid with the rolls mounted on a spaced arbor. The total grinding time is 3 minutes; but since three parts are ground at a time, sixty parts per hour are obtained.

The crushing technique has also been successfully applied to the manufacture of seaming rolls for the can industry. The making of rolling chucks used to form the odd-shaped thread form on metal caps of glass jars is greatly speeded with crush-dressed wheels. It is doubtful if the production of jet engines could have reached the requirements of the Air Corps had crush-dressing not been used for grinding the precise and intricate forms on the turbine blade root. All other methods of machining had been unsuccessful.

Today, hundreds of industrial plants are using crush-dressing. Production men in these plants, as well as engineers and technical experts, are working together to increase the usefulness of this technique. Much progress has been made in developing new applications. The future offers countless opportunities for crush-dressing as a practical and economical solution to many grinding problems. It is not often that a new shop method gains ground so rapidly.

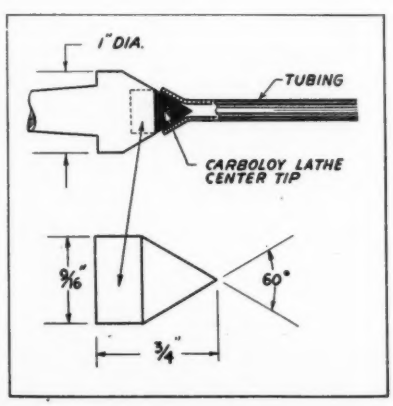
Flaring Tubes with Carbide Lathe-Center Tip

FLARING the ends of 24S-T and 14S-T aluminum tubes has been greatly expedited at the plant of the Douglas Aircraft Co., Inc., Santa Monica, Calif., through the use of a carbide lathe-center tip in place of the regular steel flaring tool ordinarily employed. The tubes are of various sizes, with inside diameters ranging from 1/4 to 3/4 inch, and the flaring operation is performed on a production basis by a Leonard precision flaring machine.

The speed range of the flaring machine is between 350 and 1000 R.P.M. The stock Carboloy C-6 lathe-center tip, made by the Carboloy Company, which is being used with such marked success, is simply brazed to a steel shank having a special taper which fits the tube flaring machine spindle. The lathe-center insert, as shown in the accompanying diagram, has an outside diameter of 9/16 inch. This center is large enough to enable the work done during the flaring operations to be performed by the carbide tip without subjecting the steel shank to wear.

It is estimated that the high-speed steel flaring tool originally used for this work produced about 100 tubes before wearing out, whereas the Carboloy flaring tool turns out at least 1000 pieces before the tool tip has to be replaced.

In addition to the saving in tool cost and less frequent interruption of the flaring operation, use of the carbide tool has also resulted in more uniform work. Production has been increased about 35 per cent, due largely to reduction in "down time" for tool changing. Flaring tools for all other tube sizes up to 1 1/2 inches inside diameter are now being tipped with cemented carbide.



Using a Carboloy Lathe-center Tip as a Tube-flaring Tool

* * *

Some companies are still carrying the extravagances—I might even say luxuries—which crept into overhead during the war until they represent today a burden that cannot be borne under a system of competition.—*George T. Trundle, Jr.*

Comparative Study of Electric and Gas-Air Methods of Silver Brazing

By PAUL F. BERG, Development Engineer
Selas Corporation of America, Philadelphia, Pa.

THE recent wide-scale acceptance of silver alloys by industrial designers for fabrication of ordnance and their present application for peacetime products have been influenced largely by new developments in heating techniques that result in production practices lending themseleves to low-cost, high-speed assembly. Investments in both electric induction and gas-air heating equipment for such purposes during the war period have unquestionably run into millions of dollars. Now the time is appropriate for a close evaluation of the relative attributes of the two systems.

Possibly the widest attention has been given to electric induction methods, despite the fact that gas-air combustion methods and equipment have been developed that are as revolutionary as induction processes. It is the purpose of this article to discuss briefly such advances and their applications, and to compare open-flame gas-air operations with induction heating in so far as shop practice and equipment selection are concerned.

Although comprehensive descriptions of recently developed gas-air combustion equipment have been published, it is well to mention here that the basic variations from conventional gas-air heating apparatus which have been responsible for recent progress involve a new technique of total premixture of the gas and air from a combustion controller which delivers the mixture at relatively high pressures. In applying the mixtures, heat is trans-

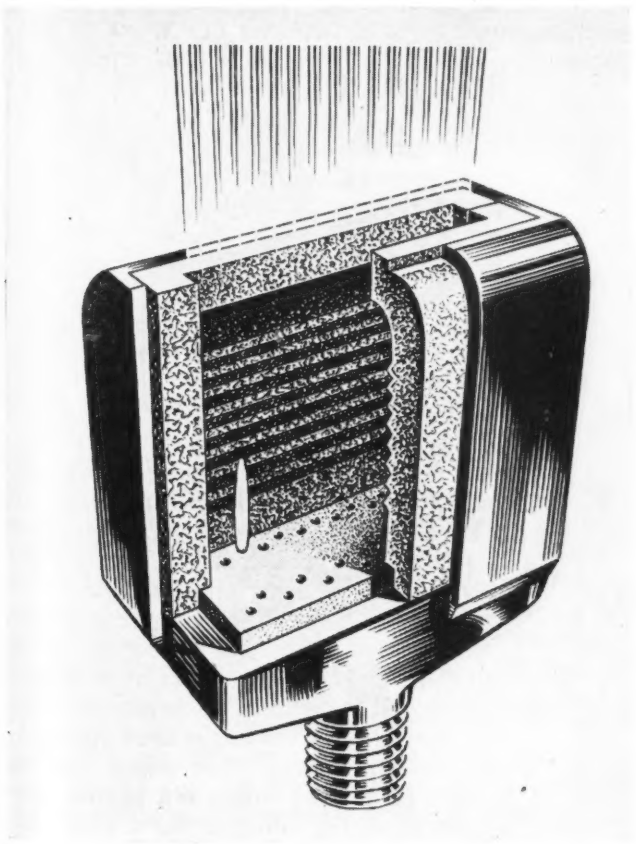


Fig. 1. Extremely Hot Gas, Velocity, and Localization of Heating Characterize the Superheat Burner. Numerous Flames Inside a Refractory Cell bring the Cell Lining to a White Heat. Heat Liberation of 50,000,000 B.T.U. per Hour per Cubic Foot can be Attained. The Outlet Slot is Narrow, can be Shaped to the Work, and can Lie within 1/4 Inch of it

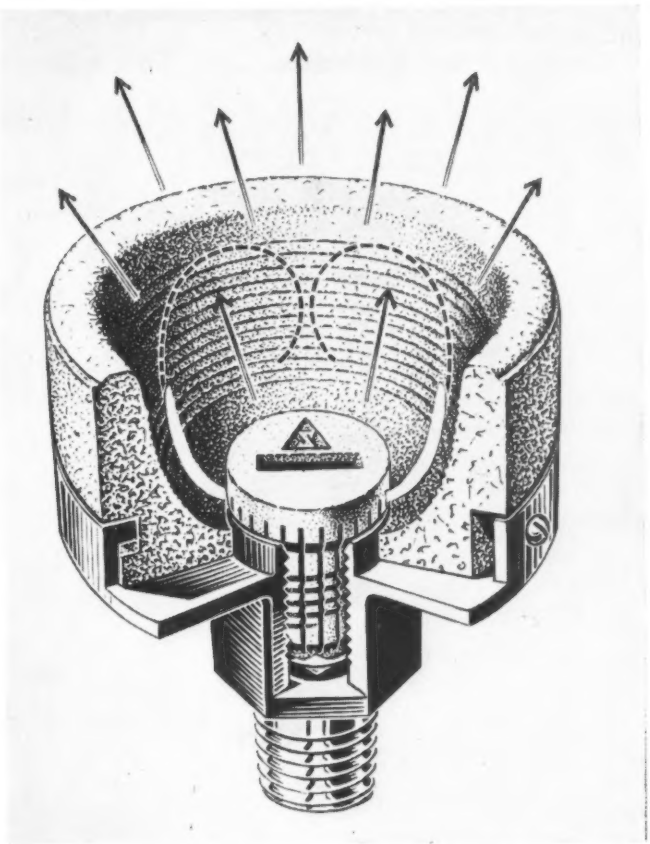


Fig. 2. In the Duradiant Burner, Completely Premixed Gas and Air under Pressure is Discharged Laterally from Numerous Slots in a Ceramic Plug at the Base of an Insulating Concavity. Thus, a Mass of Radial Flames Impinge on the Cup Wall, Bringing it to Incandescence and Insuring Complete Combustion wholly within the Insulating Concavity

mitted to the work by one of three burner types or modifications of them.

Three Principal Burner Types

The basic purpose behind the first burner type —superheat combustion—is to confine completely the combustion reaction within a small insulating refractory chamber with a restricted outlet opening. This develops such intense incandescence closely around the burning gases that the combustion reaction is greatly accelerated, tremendous quantities of heat can be liberated within very small spaces (50,000,000 B.T.U. per cubic foot of combustion space per hour), and any diluting cold secondary air is excluded from the reaction. This typical burner construction is indicated in Fig. 1.

The second type—radiant combustion—is similar to the compacted combustion of the superheat in that highly insulating and refractory molded ceramic burner parts achieve brilliant incandescence, but differs in that the radiant energy thus developed is directed at the work, and no special effort is made to confine the combustion to the smallest possible space. The entire reaction between the fuel and the combustion air proceeds on the surface of an incandescent ceramic cup rather than as a free flame of the usual nature. Fig. 2 typifies this construction.

Ceramic screen combustion—the third type—is a development of the traditional drilled metal plate type of burner, no attempt being made to compact the combustion nor to transform the heat liberated into radiant heat. Numerous ingenious methods of assembling ceramic-screen port systems for various process heating purposes have been devised. In some instances, slotted lamina of ceramic are stacked to form ports between adjacent lamina; in others, ceramic disks are pressed around needles in the die before firing, and so on. Burners of this type (but without the refinements contributed by the ceramic port screen) have been used for some time—but as part of a system employing a combustion controller supplying premixed gas and air, they should be reconsidered for flexibility and heating effects previously unobtainable.

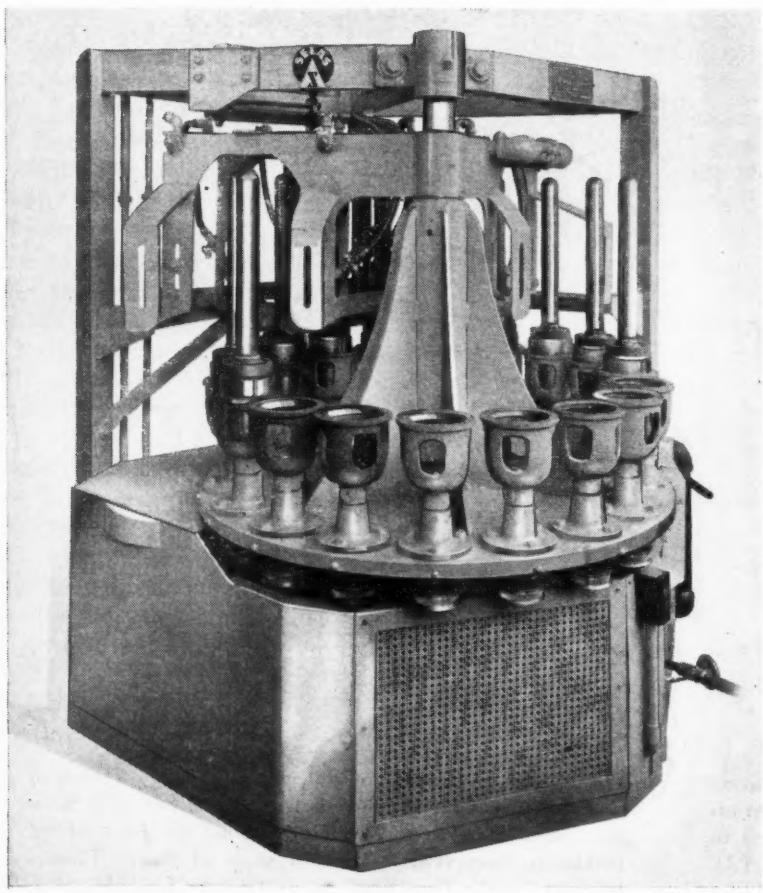


Fig. 3. Gas-air Heating Installation Arranged for Continuous Heating and Work Movement

Selection of Burner Equipment

In discussing equipment application, we must first of all accept the premise that no one heating device is an absolute cure-all for all heating problems, and particularly no one heating device or method is the answer to all silver-brazing problems. Unquestionably, during the war period, numerous equipment misapplications have been made in haste or for expediency.

The logical criteria for establishing equipment selection would seem to include: (1) Work quality; (2) work quantity; (3) flexibility of equipment; (4) operating labor cost; (5) energy cost; (6) initial cost; (7) maintenance.

In connection with the first point—that is, work quality—we are concerned first of all with securing an adequate joint, and to a lesser degree, with minimum oxidation and cleaning costs. Also, in many instances, minimizing the heated zone for maintenance of physical properties and distortion control is significant.

The attaining of an adequate joint in silver brazing involves adequate cleansing, fluxing, and the raising of the temperature of the pieces being joined, as well as the alloy itself, slightly above the flow point of the alloy. With proper distribution of heat energy, this result can readily be attained by either induction or gas-air energy. Under the pressure of wartime production demands, numerous rejections of material were reported due to too rapid heating by induction equipment. Too rapid heating —by any method—does not permit adequate time for alloy flow, a condition resulting in pin-hole joints.

Although equipment for the attainment of high heating speeds with gas-air has been described, it is not possible to obtain the speeds of the higher frequency induction units (power concentrations in the two cases being about 300 B.T.U. per minute per square inch

of area, and 5000 B.T.U. per minute per square inch of area, respectively). On the other hand, it is because of the relatively low power input in the case of gas-air heating—and the attendant heat soaking period—that, to the writer's knowledge, no rejections due to over-rapid heating have been reported.

Inasmuch as oxidation is a time-temperature effect, the advantage in this particular is in favor of induction heating. Even with the somewhat greater time cycle of gas-air heating, however, this problem is rarely a critical one.

Points (2) and (3)—work quantity and flexibility of equipment—are governed by geometry-size factors. Since the geometry and size of a piece of work establish whether an induction device should be of the motor-generator or electronic type, it is obvious that there are certain restrictions placed on the flexibility of induction equipment. The fields of usefulness for the two types of equipment have been generally defined. It is recommended that the larger masses should be heated at relatively low power concentrations (motor-generator sets), and the smaller masses at higher power concentrations and frequencies (electronic sets). This, then, is the fundamental limitation for induction equipment in so far as flexibility is concerned.

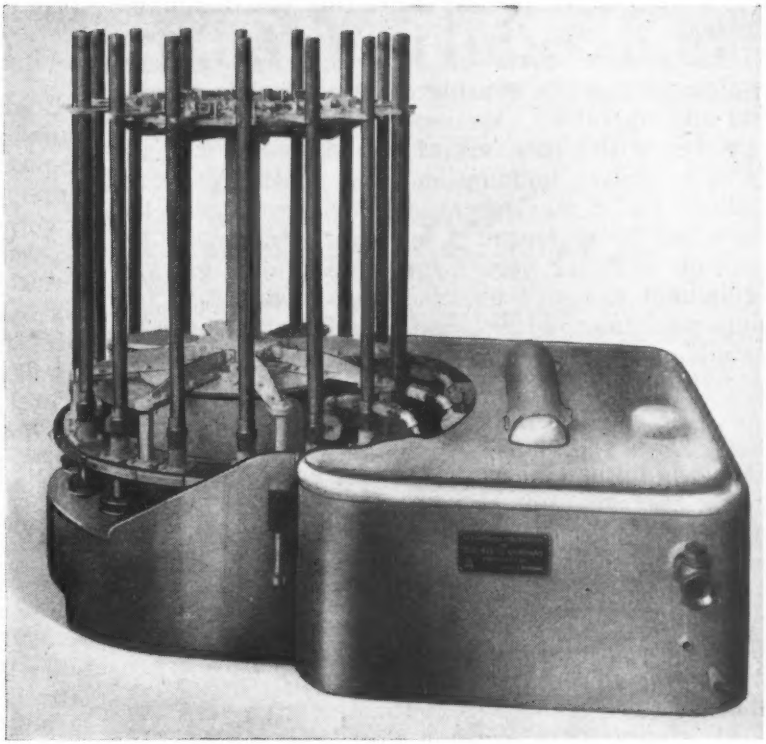


Fig. 4. Another Example where, by Continuous Work Movement, Labor Costs are Reduced, One or Two Operators Only being Required for High-volume Production

Another thought predominant in the minds of those governing equipment selection, in so far as induction types are concerned, should be whether the volume of work processed is great enough and similar enough in geometry and size to maintain the unit's operation on a substantially constant basis, in order to amortize the equipment cost within a reasonable period of time.

In the case of gas-air equipment, the geometry-size factor is not a critical one. The combustion controller (which represents the main cost item) will be the same (except for capacity) for all silver-brazing requirements. The most frequent change required would be a repositioning of the burner (analogous to a coil change with induction equipment). The geometry-size factor otherwise might effect a simple change in the type and number of burners. This system, therefore, provides a maximum flexibility, is adaptable for great or small production requirements, and is not influenced by geometry or size of work. These facts indicate that amortization possibilities within a short period of time for general processing work are clearly in favor of gas-air.

As in all processing, those charged with the responsibility of equipment selection must consider labor costs. A perusal of the literature reveals that the most prevalent induction installation is, essentially, a heating station where one or a number of work-pieces are inserted in and removed from the heating coil manually, each station or machine requiring the full-time attention of at least one operator. Gas-air equipment manufacturers, less influenced by geometry-size limitations, have reduced labor costs to a minimum by supplementing the energy system with mechanical, continuous work movement means. Figs. 3 and 4 illustrate this method of reducing labor costs, only one or two operators being required to perform the work with this equipment.

Prudence should provoke caution in a discussion of comparative energy and equipment costs for specific cases. The writer's data is limited to comparative costs for a few specific pieces of work. Certainly, however, the advantage is in favor of gas-air under any gas rate condition.

Despite the limitations of using only a couple of specific cases, the following general comparisons, which are representative, may prove helpful to those charged with the duty of applying sound managerial and engineering principles in equipment selection. In the case of the silver-brazing of multiple joints in a steel tubular assembly, the author has himself definitely ascertained that the cost of producing the required heat was 0.7 cent per unit in the case of gas-air heating, and 5 cents per unit in the case of induction heating. The initial investment for an equal amount of production was a great many times larger in the case of induction heating, compared with gas-air heating. In another case—the silver-brazing of a tubular Army ordnance unit—the energy cost per 1000 pieces was only 54 cents using the gas-air method, com-

pared with approximately $10 using the induction method.

Maintenance costs of induction and gas-air equipment must be considered as cautiously as initial and operating expenses. Generally speaking, however, with either type of equipment—in a small (single unit) installation—the most frequent failures (tube, condensers, coil, or burner) can be remedied by replacement by plant personnel. In multiple units or very large installations, gas-air equipment can still be adequately maintained by shop mechanics, whereas a trained engineer would be advantageous to handle more complex failures with induction equipment.

J. P. Jordan (in *Metals and Alloys*, May, 1944, page 1153) reports that maintenance costs are definitely higher for radio-frequency units than for motor-generator sets. He says that radio-frequency sets average from 10 to 50 cents per hour, depending on the tube complements and rating used.

The greatest maintenance cost of gas-air equipment is for burners. It is questionable if this cost has ever exceeded one or two cents per hour for the average brazing installation.

Since 1941, managing and engineering staffs in most plants have reached decisions relating to equipment selection and fabrication methods under duress from one source or another. Frequently decisions were made with the main consideration of delivery to the armed services. To escape this obviously faulty practice in terms of a peacetime economy, a new view must be accepted—an industrial economy conforming to our pre-war standards.

Industry, to survive increasingly competitive markets, must again revert to methods yielding quality products at the lowest unit cost. Wartime fabrication techniques indicate clearly the advantages of employing assembly by silver brazing to replace more expensive machined, welded, pressed, riveted, etc., products. Wartime experience indicates equally as clearly that great differentials in unit cost can be attributed directly to misapplication of equipment in specific cases. Engineers and management must appreciate this and realize that there will be a day of reckoning in the revival of a stabilized peacetime economy.

* * *

Manodyz Process for Manganese

An electrolytic process known as "Manodyz" has been developed by the Hanson-Van Winkle-Munning Co, Matawan, N. J. Through the application of this process, a protective and decorative magnesium-oxide-silicate film is produced on magnesium alloys. The function of the coating is similar to the aluminum-oxide film on anodized aluminum alloys. Either alternating or direct current can be used for the Manodyz tank. The alternating-current finish may vary in depth from 0.0002 to 0.0005 inch; the direct-current coating varies in depth from 0.0004 to 0.001 inch. Under normal operating conditions, magnesium parts may be completely processed in thirty minutes.

International Agreements Reached on Screw Threads

Engineers from the United States, Britain, and Canada recently met at Ottawa, Canada, under the auspices of the Combined Production and Resources Board, in a conference on the unification of engineering standards. A specification was developed for a basic thread form that would provide a unified standard for all countries employing the inch system. This basic form retains the best features of the present thread forms. A series of diameters and pitches was worked out which would simplify existing practice and yet provide an adequate range of choice for all general requirements. The proposed change involves a minimum departure from existing practices, consistent with obtaining the desired object.

An agreement was also reached on Acme and Stub-Acme threads. These proposed specifications will be submitted to industry in the three countries through the national standards bodies, and it is felt certain that a standard will be speedily approved. A mutual understanding was reached on specifications for small screws, such as are used in watches and clocks. Agreement was also reached on proposed standards for threads on microscope lenses, camera parts, micrometers, and other fine "motion" screw threads.

Special thread forms were discussed, and an understanding on certain specification aspects of the buttress thread form was reached. Considerable progress was made in the assembling of engineering data on high-duty studs in light alloys, but the diversity of practices made it impossible to formulate definite recommendations for a unified practice. A meeting held on pipe threads, while not conclusive in its findings, resulted in an invitation to British and Canadian representatives to continue discussions at a coming meeting of the American Petroleum Institute.

* * *

Magnesium Exhibit and Symposium

A symposium and exhibit on magnesium will be held at the Hotel New Yorker on the evening of January 16, under the sponsorship of the Metropolitan Section of the American Society of Mechanical Engineers and the Greater New York Chapter No. 34 of the American Society of Tool Engineers. Short talks will be given on the following phases of the subject: "Engineering with Magnesium," by Otis E. Grant of the New York office of the Dow Chemical Co.; "Wrought Magnesium Alloys, Their Fabrication, Properties, and Uses," by E. S. Bunn, metallurgical manager, Revere Copper & Brass, Inc.; and "Past, Present, and Future of Magnesium," by Dan W. Moll, vice-president and treasurer of the Hills-McCanna Co., Foundry Division, and chairman of the Casting Division of the Magnesium Association. A sound motion picture, "Magnesium—the Miracle Metal" will be shown.

How to Deal with Surplus Machine Tools

Abstract of an Address by A. G. Bryant, Vice-President of Cleereman Machine Tool Co., and President of Bryant Machinery & Engineering Co., Made at the Recent Annual Meeting of the American Machine Tool Distributors' Association

THE machine tool industry was not encouraged by the Government in this country previous to the war as it might have been in consideration of its vital importance to both peacetime economics and wartime needs. No such support was given it here as was provided for the German machine tool industry, in order that it might be ready for war requirements. The manner in which the machine tool industry was encouraged in Germany in the thirties enabled a large accumulation of machine tools to be created to support the gigantic war machine which came perilously close to world domination. Since modern machine tools are as necessary to maintaining a high standard of living in peacetime as to providing the implements of destruction in wartime, it would have been just as sensible for a peaceful nation to create conditions to encourage the machine tool industry as it was for an aggressor nation to do so for purposes of war.

In our country, the excess profits tax has been applied with special severity to machine tool companies, and no favorable consideration has been granted the industry by either the Treasury Department or by Congress. Renegotiation, intended originally to apply solely to producers of war materials, and expected by many leaders in Congress to affect the machine tool industry only superficially, became finally an instrument of confiscation. After having been taxed and renegotiated, many machine tool builders realized not more than a 3 per cent net return on sales, and many machine tool distributors less than 1 per cent.

Looking at another side of the picture—current shipments have declined to 20 per cent of the peak rate. Yet machine tool prices remain frozen by the OPA at the 1941 basis, although labor costs have increased in many instances 50 per cent, and total costs even more. With competition restored in the industry and with the sale of Government surplus machines at a price averaging 40 per cent of the price of new machines, the industry is forced to exhaust itself in elaborate appeals to the OPA for even those minor adjustments that should be matters of business routine; and oblivious of the realities of the present industrial situation, the Government continues its unfair discrimination through renegotiation proceedings.

Further, there is the surplus machine tool equipment, which is a formidable competitor to the industry. One issue that dismays us is the apparent complacency with which the country is avoiding the setting up of a really adequate strategic military reserve of machine tools. Production men, and the military as well, are aware of the fact that without machine tools we cannot produce war materiel.

The public does not generally realize that it was not until we were able to manufacture a sufficient amount of machine tools that we turned out the planes, the ships, and the guns necessary to overwhelm our enemy. The ordnance branch of the Army, the Air Corps, the Navy, and the business men composing the driving force of the War Production Board knew in 1940, 1941, and 1942 how desperate was the need for machine tools. They realize that we must have machine tools quickly available so that in an emergency we can produce those weapons of war which inventive genius will continue to create.

There is such an enormous volume of machines available that reconversion need not be retarded in the slightest because of any lack of them. We might safely set aside one-third or one-half of each of the different types of machine tools now owned by the Government, and still have available in all these classifications ample quantities for all the requirements of the country. If such a reserve were set up, even temporarily, we could be sure in an emergency of being ready to produce, and the economy of the country would not be adversely affected in any degree.

There is only one real solution for the attainment of an adequate military reserve of machine tools, and that is for the appropriate Military and Naval Affairs Committees of the House and Senate to initiate immediate legislation for approval of Congress and the President, requiring that we preserve an adequate supply of the machines that the Government has already purchased, as a bulwark of national defense.

The industry does not ask for protection in the form of subsidies; but it does ask for relief from the burden of unnecessary Government controls. A continuation of OPA price control over the machine tool industry is a hindrance, has no influence whatsoever on inflationary tendencies, and hampers many efforts toward reconversion. It should be eliminated at once.

Other controls inaugurated during the war and still remaining have an adverse effect upon a heavily burdened and harassed machine tool industry, and should be dropped.

Seven recommendations are proposed:

1. Let the President and the Congress order the setting aside immediately of one-half of the Gov-

ernment-owned machine tools, in all of their classifications, as a military reserve, subject to review within two years for disposition at that time in the light of international conditions.

2. Let the State and Commerce Departments immediately facilitate and expedite channels for export machine tool trade, permitting free and private commercial relations, so that the industry may compete for the markets now being absorbed by England and other commercially minded nations.

3. Let OPA immediately suspend price control as applied to the machine tool industry, in view of the industry's highly competitive status, and because the more new machine tools are sold, the lower will be the cost of goods, thus counteracting inflation.

4. Let Congress initiate a provision making possible a carry-back of losses of machine tool companies, for 1946 and subsequent years, against renegotiation refunds which were paid to the Government during the war by such concerns, and whose normal post-war business was absorbed by the manufacture of their regular product during the war period.

5. Let the Surplus Property Administrator and the RFC initiate at once the proposed plan for the participation of machine tool builders and distributors in the sale of surplus through the instrument of a properly established commission arrangement, and let the administrator and the RFC establish immediately an advisory committee composed of machine tool builders, machine tool distributors, and used machinery dealers, for regular counsel with regard to its policies in the disposal of machine tools.

6. Let the industry itself, with every constructive resource at its command, proceed with the education of the general public in the economics of machine tools, their importance in creating employment, in raising the standard of living, and in maintaining our national defense.

7. Let us in the machine tool industry with courage and vision rededicate ourselves to the manufacture of even finer machines, and to the introduction of these machines where they will aid in the upbuilding of our country's future. Let us demonstrate again the self-reliance, the ingenuity, and the fortitude that has typified the history of the machine tool industry.

Only Remedy for Labor Unrest is Genuine Worker-Management Cooperation

A LETTER relating to the recent Labor-Management Conference has been addressed to President Truman by James F. Lincoln, president of the Lincoln Electric Co., Cleveland, Ohio. In this letter, Mr. Lincoln says:

"The bells are tolling for the recent Labor-Management Conference, and according to newspaper reports you are expecting to take an active hand in an attempt to end the present civil war between labor and management.

"Consequently, I am emboldened to make a suggestion that in any future efforts you seek a method of eliminating this civil war instead of writing new rules or interpreting the existing rules.

"Any system that is based on higher wages without a corresponding increase in production can result in only one thing—inflation. Our only economic hope lies in increased worker efficiency. Higher worker efficiency can be secured through the cooperation of management and worker. This statement is based upon fact and not upon theory.

"For twelve years our plan has produced an increased efficiency of operation which has been far beyond that obtained by any other organization of which I can get a record. In my letter to you of September 4, I outlined the results achieved through this cooperation between management and worker. These results are so important that I feel they will bear repeating:

"1. No strife. Not a single hour has ever been lost through misunderstanding between worker and management.

"2. Continuous employment. No person in the last twenty years has been laid off because of lack of work.

"3. Steady income. No reduction in wage rates made in that period.

"4. More jobs. The number of people employed has been increased by more than four times.

"5. Wider markets through lower costs. It has been possible to reduce selling price by more than 60 per cent while all other manufacturing products have been increased by an average of 25 per cent, resulting in wider distribution, both domestic and foreign.

"6. More pay. The earnings per man have been increased by more than four times, which is double that of industry in general. Last year average compensation per man was in excess of $5800.

"7. Financial stability. The dividends to the owners or shareholders (practically all of whom are workers) have been continuous and increasing.

"The Labor-Management Conference has failed to produce any tangible results. Strikes and threatened strikes have increased throughout the country. Tension and feelings run higher than they ever have. Under these conditions, instead of writing rules, would it not be well to encourage industry to seek a plan of operation which will produce the results I have indicated?"

What the Designer Should Know About Welded Machinery Parts

A Few Basic Considerations to Aid the Engineer in Planning Designs of Machines and Structures Suitable for Construction by Welding — Abstract of a Paper Read Before the Recent Annual Meeting of the American Society of Mechanical Engineers First of Two Articles

By GEORGE L. SNYDER
Chief Engineer, Lukenweld, Inc.
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Coatesville, Pa.

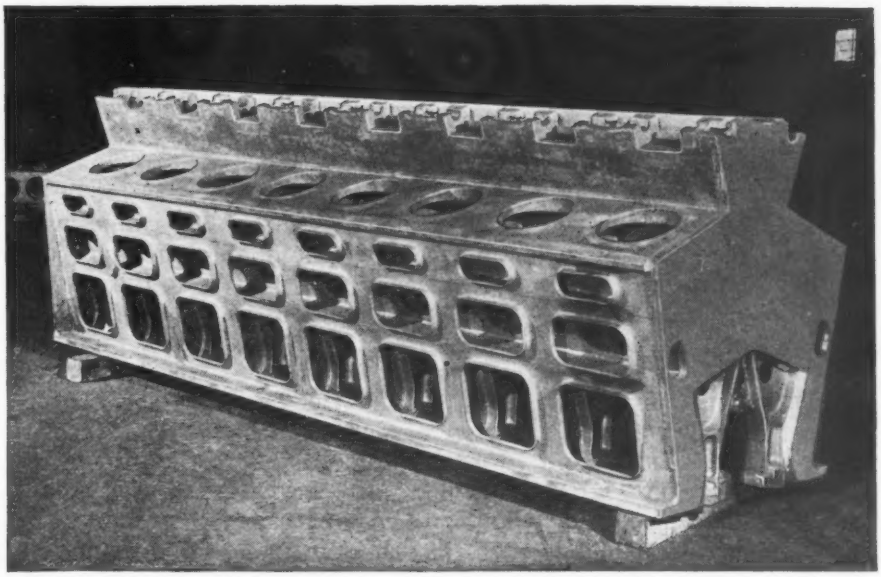


Fig. 1. Sixteen-cylinder V-type Welded Diesel-engine Frame

THE designer must be familiar with both the possibilities and limitations of welded structures and with the scope and limitations of the equipment and methods used in their fabrication. The present discussion is limited to dynamically loaded welded machinery parts. Statically loaded welded structures present another broad subject, with design concepts decidedly different from those of dynamically loaded structures.

Hot-rolled steel plate is probably the most universal component used in structures made by welding. It is a flexible material from the standpoint of dimensions, since hot-rolled plate is obtainable in sizes up to 195 inches wide and up to 25 inches thick.

Shearing usually is the most economical method of sizing or shaping a plate to rectangular or circular shapes. When the shapes are irregular, flame-cutting is undoubtedly the most common method of sizing weldment components. Since shapes that are not too irregular are cheaper to produce, the designer should aim to use such shapes whenever possible. In addition to shaping or sizing, the cutting torch is used for producing welding chamfers or kerfs on the edges of a component part. These chamfers provide the grooves for welds when assembled with adjoining components.

Often, it is advantageous to size components on machine tools, if only for the reason that much closer tolerances are obtainable. For a complicated assembly with much welding on it, prefabrication machining is recommended; also, at times, machining of components will help achieve close tolerances on a complete weldment. The more generous the

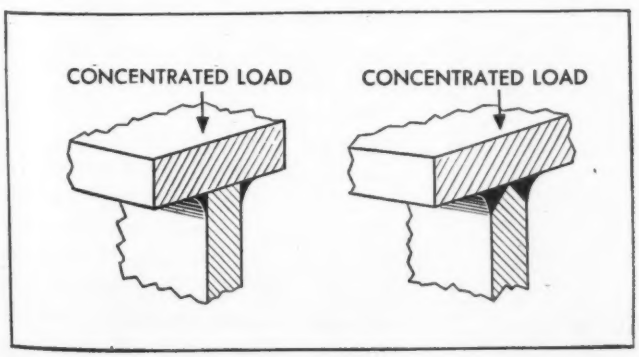


Fig. 2. Joint between Heavy Flange and Web, Showing Machined Edge at Left and Full Weld at Right

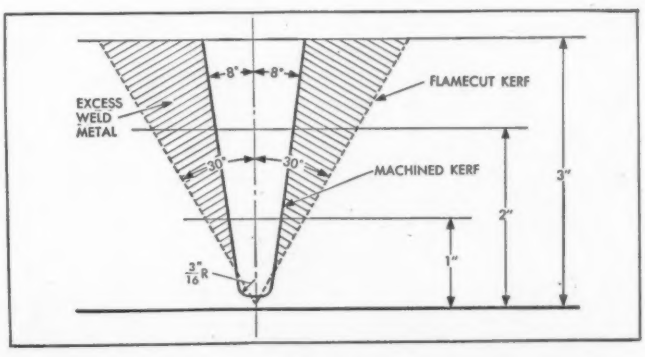


Fig. 3. Comparison of Amount of Weld Metal Used with U- and V-shaped Welding Kerfs

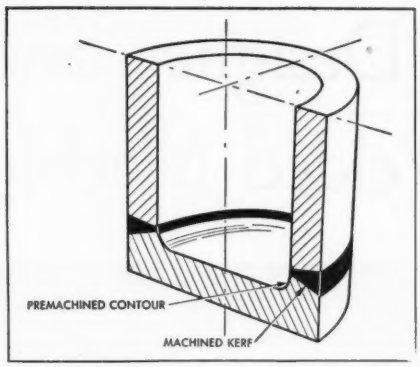


Fig. 4. Bottom Plate of a Hydraulic Cylinder Such as Used in Heavy Hydraulic Presses, Premachined to Provide Curved Contour at the Inside Corners

tolerances on components, the more prevalent the gaps in fitting. Gaps require the deposition of a greater amount of weld metal, thereby increasing costs and destroying the metal-to-metal contact which resists tendencies of the weldments to shrink or warp.

The main structural parts of the weldment shown in Fig. 1 are premachined. Since this frame is made on a mass production basis, individual peculiarities in each weldment caused by the non-uniform accumulation of component tolerances could not be permitted.

Sometimes design considerations dictate prefabrication machining, as in the case of the joint between the heavy web and flange shown at the left in Fig. 2. This might be a detail of construction on the bed of a large hydraulic or mechanical press. The loading in the region of the compression flange of such machines is such that the joint construction shown at the right in Fig. 2 would be necessary, if the edge of the web were not machined. When machined, the metal-to-metal bearing required to withstand concentrated compression loads is achieved. Fillet welds, as indicated in this illustration, are adequate then for withstanding the horizontal shear components in this region of the beam. The edging of such webs to a relatively close tolerance is a simple operation on a plate planer.

Another reason for prefabrication machining is to provide economical welding kerfs in combination with good joint fit-up, particularly in welding thick plates. The kerf must be sufficiently wide to clear the tip of the welding electrode so as to permit the depositing of weld metal at the root of the weld; for, as the plate thickness increases, it is apparent from Fig. 3 that the amount of metal wasted in the angularity of V-shaped flame-cut kerfs in contrast to the U-shaped ones becomes an important factor.

Prefabrication machining is often necessary in the fitting of circular components within each other. Small spaces between pieces so fitted are inevitable, but machined fits reduce such clearances to a negligible point.

Prefabrication machining is necessary at times, also, for providing proper contours in highly stressed weldments or in those subject to fatigue. Such an instance is shown in Fig. 4, which represents the bottom plate of a hydraulic cylinder premachined to provide the proper curved contour at the corners. It also illustrates an application of machined kerfs to thick plates. Another method used frequently for shaping plate components is blanking or punching on a power press.

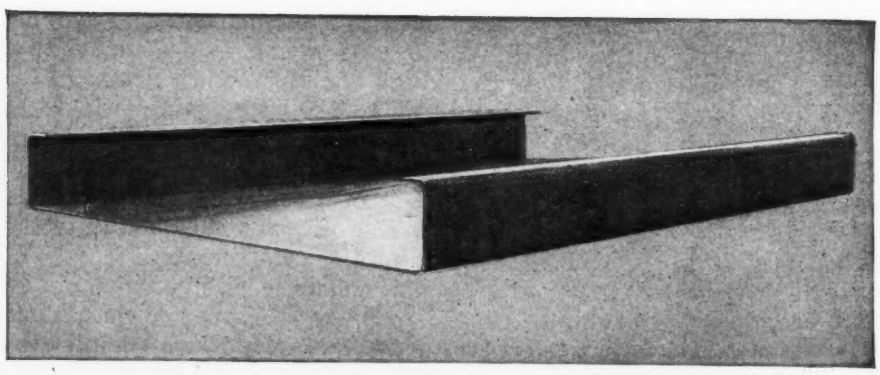


Fig. 5. Horizontal Angular Bends Provided by Press Bending

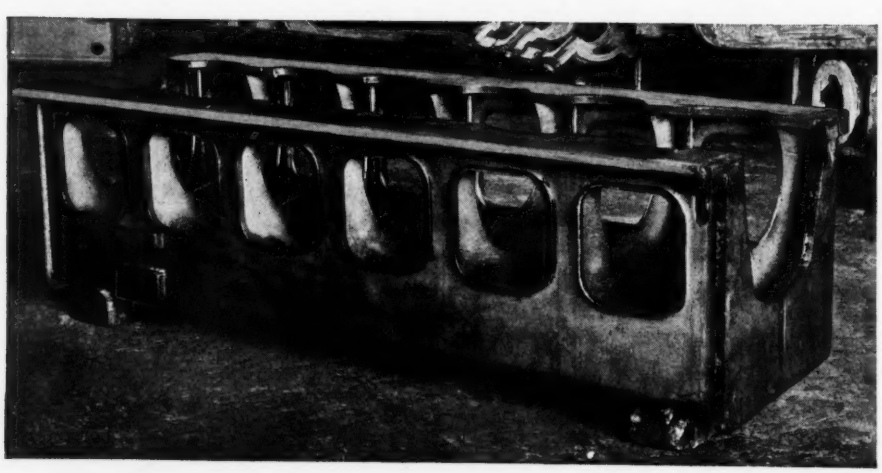


Fig. 6. Weldment Showing Utilization of Flued Openings

"Formed" Components

Thus far we have considered only flat pieces in the preparation of components, but we must give thought also to formed type components, which are required frequently in weldments. Several methods are in general use for forming components for weldments. One of these is press bending, which is used for horizontal angular bends, as shown in Fig. 5.

There are definite reasons for forming operations such as bending or "flueing." One is lower cost, for angular bends eliminate one or more welded joints. The cost of bending seldom equals that of assembly and welding. Careful examina-

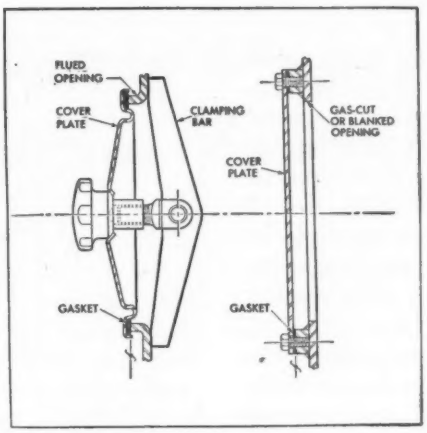


Fig. 7. Formed-seat Cover Designed to be Fastened by an Inner Clamp (Left). Assembly, Welding, and Consequent Warpage, as well as the Cost of Drilled and Tapped Holes are Eliminated, as Compared with Design Shown at the Right

tion of the design proportions of metal sections might show the economy of using the same metal thickness of web and flange to utilize the advantage of a bent section. A bent component naturally is more rigid than a flat one. This can be important in the control of shrinkage and warpage.

Another method, often of value in component production, is the specialized forming operation known as "flueing." Flued openings, such as shown in Fig. 6, when machined, provide formed seats for covers. Generally, such covers are designed to be fastened by an inner clamp as shown at the left in Fig. 7. The flued opening eliminates assembly, welding, and consequent warpage, as well as the cost of many drilled and tapped holes necessitated by the design at the right in Fig. 7. In addition, weight reduction is achieved.

Another function of flued openings in weldments is to provided stiffening lips, which are produced normally by welding a band around the opening where required by design considerations. Since dies are necessary, flued openings are unwarranted economically unless the quantity of openings justifies their use. When flued openings are being considered, the designer should consult the supplier, for it is possible that dies exist which can be adapted.

Products of flanging, or spinning, machines often are utilized to advantage in weldments, as their applications in the melting pots in Fig. 8 show. The bottom corner at the end of the pot in the lower illustration is composed of a flanged head split in half, one half serving for each end.

The use of flanged products as components may provide rigidity, possibly simpler welding conditions, or a reduction of welding. Flanging also provides curved contours which may be desired for proper functioning or for appearance.

Stamping and Pressing of Parts to be Welded

When quantities justify it, formed components produced in special shapes by forming dies on power presses can be used advantageously. Fig. 10 shows a small stamping and Fig. 9 shows the weldment in which four of these stampings form the corners of the piece. The forming required on the remaining components is done on a press brake. Fig. 11 shows the relation of the various components in this weldment. A useful method of shap-

Fig. 8. Melting Pots Using Flanged Products as Components

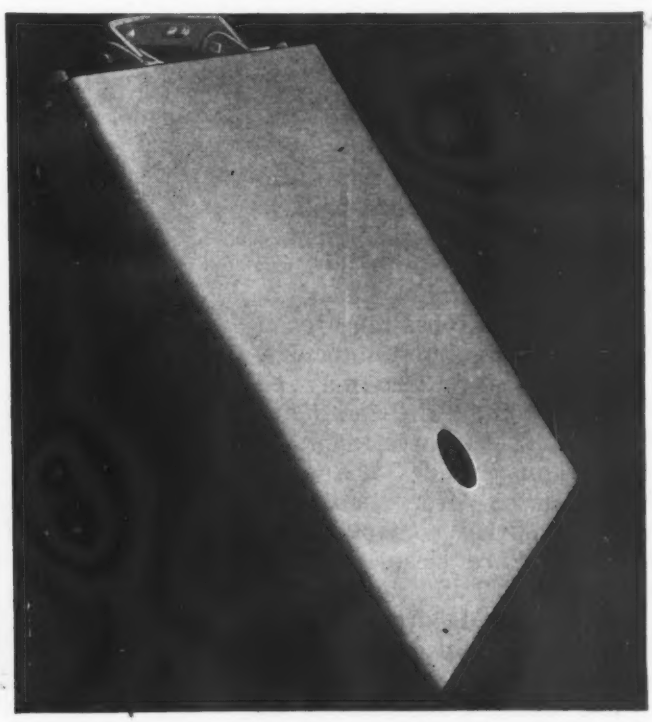


Fig. 9. Furnace Door Using Corner Stampings Shown in Fig. 10

ing cylindrical contours is provided by bending rolls.

At times, shapes formed on a rolling mill can be used in weldments. Their value as components results from two factors—a reduction in cost because of elimination of welding, and initial rigidity which tends to simplify fabrication problems of shrinkage and warpage. In considering the use of structural rolled shapes, the tolerances possible in such rolling-mill products should be studied carefully, for they may affect adversely the design requirements.

Steel castings are used extensively as components in weldments where economy in producing complicated shape requirements or special contours at given points in a particular assembly is involved. When castings are to be used in weldments, their physical and chemical properties should be specified carefully. Also, when size permits, it is desirable to have castings of electric furnace steel, which seems to possess greater cleanliness. This is important in obtaining good welds with minimum difficulty.

Drop-forgings also may be used when their size and quantity justify the investment in dies. This product has good homogeneous properties, and when properly controlled, its tolerances are close. Fig. 12 shows such an application, where several drop-forgings have been joined by flash-welding.

The present installment of this treatise has dealt with the production and application of component parts in weldments; fabrication from the designer's viewpoint will be dealt with in the second article on this subject, to be published in February MACHINERY. In that installment will also be covered application of sub-assemblies, types of welded joints, and various other points that the designer should take into account.

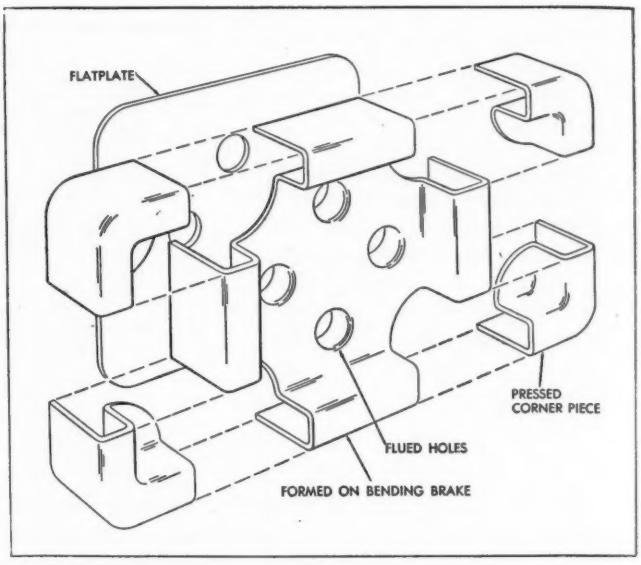


Fig. 11. Perspective View Showing Construction of the Water-cooled Furnace Door Seen in Fig. 9

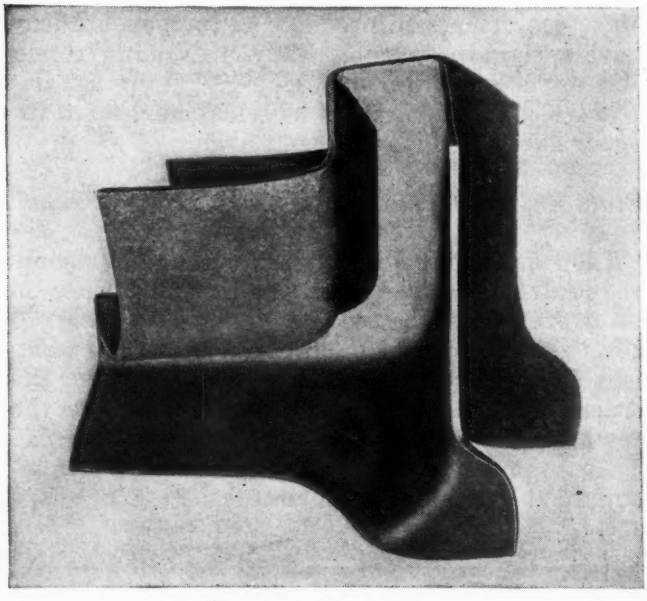


Fig. 10. Corner Stamping for Water-cooled Furnace Door Shown in Fig. 9

* * *

Gearing Industry Still Very Active

The gearing industry, as represented by the members of the American Gear Manufacturers Association, shows an increase of 18 per cent in volume of sales for October, 1945—the last month for which complete statistics are available—as compared with September. This report does not include turbine or propulsion gearing.

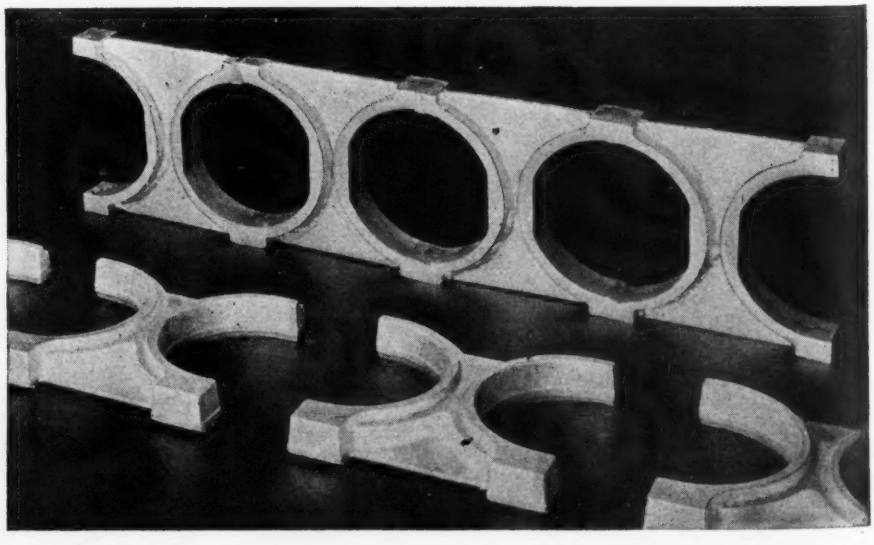


Fig. 12. Typical Use of Drop-forgings and Flash-welding to Provide Components of Irregular Shape and Difficult Proportions

Recommendations by Machine Tool Dealers on Surplus Machine Tools

AT the recent annual meeting of the American Machine Tool Distributors' Association, held in Cleveland, Ohio, the Committee on Surplus Property, of which R. L. Giebel, of Giebel, Inc., New York City, is chairman, presented a report on this subject. As a result of this presentation, a suggested procedure for the orderly disposal of Government-owned surplus machine tools was laid before the Association and approved. The suggested procedure is as follows:

1. Permit all Federal Government departments to retain any and all machine tools they desire, within practical limits, for which they are now accountable, and immediately report the remainder as surplus, giving complete specifications—covering standard and special accessories—including name of manufacturer, number and size of machine, serial number, motors, controls and current, original consignee, and present location.

2. Permit private organizations who now have under their supervision Government machines to buy them immediately, using the Clayton Formula for pricing, or report them as surplus and give complete specifications, as outlined under No. 1.

3. Permit the Army, Navy, or any other Federal, state, and municipal divisions to requisition whatever machines they think they may want for present, future, or "stand-by" needs from this surplus, and immediately transfer those machines to that organization "as is."

4. Set aside in dead storage, for an indefinite period, between 33 1/3 and 50 per cent of the remaining standard machines as a protection for future requirements. These are as important as actual fighting equipment in our program of national defense.

5. Contact all the original manufacturers and advise them of the number of machines listed as "surplus" remaining, offering them the privilege of buying, on suitable terms, any number of these machines witthin sixty days after being notified, at a price determined by the Clayton Formula less an adequate discount, with the proviso that the manufacturer dispose of them through his regular channels.

6. After the above operations are completed, compile a record of all the remaining machines and classify them for usability. Then provide centralized storage places and showrooms for those that can be used, and scrap the remainder.

7. Machines may be sold "as is" by the Reconstruction Finance Corporation. They may be purchased by anyone for his own use, using the Clayton Formula. If sold through the efforts of an approved sales organization or individual, the R.F.C. will carry the account and compensate the seller at the rate of 15 per cent. Regular machine tool procedure will be adhered to, except that there are to be no territory limitations.

8. We would recommend that the Surplus Property Board give some price inducement to purchasers of Government-owned machine tools for replacement, provided that the purchaser would agree to scrap an equivalent type and size of machine tool which the purchaser has had in his possession for at least one year and which is being replaced.

9. We recommend that the R.F.C. and Surplus Property Board form immediately a joint advisory committee, consisting of representatives of the National Machine Tool Builders' Association, the Machinery Dealers National Association, and the American Machine Tool Distributors' Association, to meet regularly in an advisory capacity.

Tool Engineers Exposition in Cleveland

COMPREHENSIVE plans for the American Society of Tool Engineers' "New Era" Exposition are gradually being completed. This show will be held in the Cleveland Public Auditorium, Cleveland, Ohio, April 8 to 12, as announced in December MACHINERY. This is the first show sponsored by the American Society of Tool Engineers in three years, and will be the fifth show conducted by the Society.

The scope of the show is planned to be broad and indicative of the expanding influence of the tool engineer in many different phases of production. Aside from machines and tools, the display is planned to include other production equipment and inspection instruments, as well as materials, material-handling equipment, drafting-room supplies and tools, devices for determining production cost and job evaluation, coolants and lubricants, and control systems of pneumatic, hydraulic, electrical, and electronic design. Admittance to the show will be by pass only, assuring that all visitors will be particularly interested in the equipment and materials exhibited.

Concurrently with the exposition, the Society will hold its annual meeting. A series of technical sessions has been scheduled, and subjects of general interest in the tool engineering and production field will be brought up for debate and discussion.

Set-Ups That Solved Nine

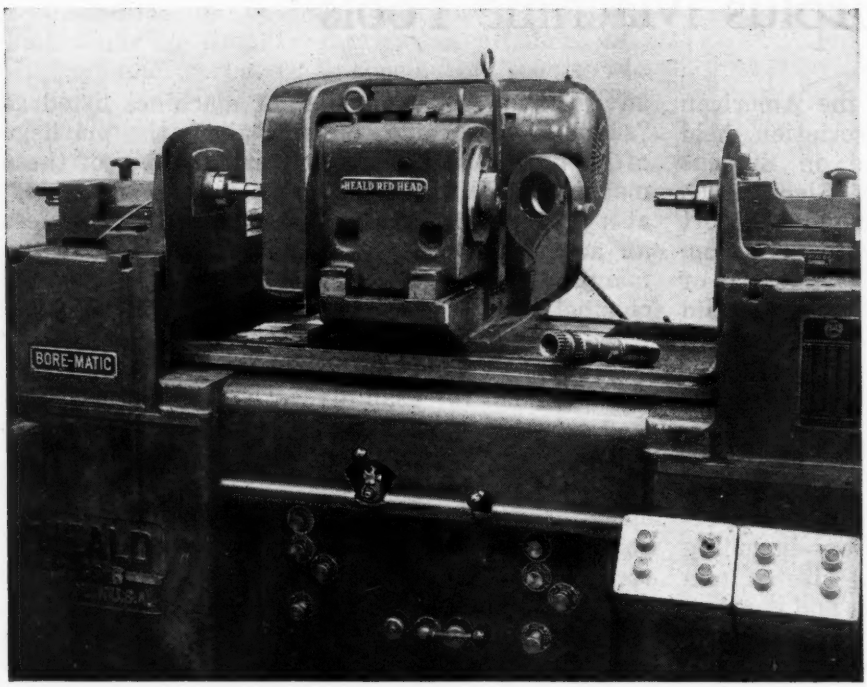


Fig. 1. Bushings in Both Ends of Aircraft Impeller Shaft Assemblies Bored at a Single Chucking

PRACTICALLY all borizing (precision machining) jobs pose special problems. It may be desired to increase production or to reduce costs, to achieve extremely close limits, to handle a large or difficult work-piece, or to combine several of these objectives. Sometimes the problem can be solved only by a special machine. Sometimes ingenious or complicated fixtures or tooling are needed; but often a really difficult problem can be solved with a comparatively simple set-up.

The problem solved by the set-up on the Heald Bore-Matic shown in Fig. 1 was to bore the bronze bushings in both ends of aircraft impeller shaft assemblies to practically dead alignment, holding the size to within 0.0007 inch, concentricity to 0.002 inch total indicator reading, and surface finish to 10 to 12 micro-inches. The stock removal runs from 0.008 to 0.010 inch.

To insure maximum concentricity and alignment of the bores, it was necessary to bore the piece from both ends at a single chucking. Obviously, that could not be done by the conventional method of rotating the work in a boring head supported on the machine bridge. The solution was to put the work-head on the machine table and employ opposed stationary boring-bars on the two bridges.

The work-head is a hollow-spindle boring head with its own motor drive, and is equipped with plain bearings in order to meet the high finish requirements. The impeller shaft is inserted in the hollow spindle and located from bevels at each end, one end being supported by a fixed center, and the other being both located and clamped by a removable screw type center.

The boring-bars are carefully located in line, thus producing bushings that are in exact alignment. Both bars are of the pivoted adjustable type, which allows quick but accurate adjustment of the tools. The bushings are back-bored to prevent tool drag lines. The cycle is automatic, the table feeding in two directions and back to a center stop position.

The set-up shown in Fig. 2 solved the problem of obtaining high production on refrigerator frames which had to be bored, counterbored, chamfered, and

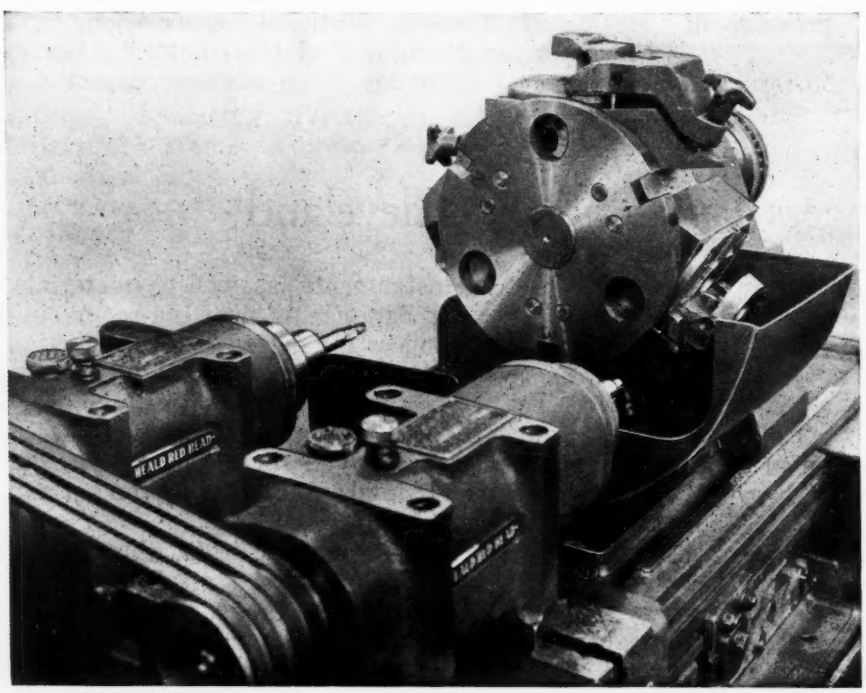


Fig. 2. High Production in the Machining of Refrigerator Frames was Obtained with a Three-station Automatic Indexing Fixture

Borizing Problems

By C. G. NORDMARK
Heald Machine Co., Worcester, Mass.

necked from the solid. The high-production stipulation suggested a fixture that would permit loading one part while others were being machined and an automatic cycle. Since the part was to be machined from the solid, two stations were needed—one for the roughing and one for the finishing operations.

The roughing is done at the rear station by a special drill, held by an adapter, which drills, counterbores, and chamfers from the solid. The finishing is done at the front station by tungsten-carbide tools, which finish-bore the drilled hole, finish the counterbore, and cut a neck in the bottom of the counterbore.

Progressive operations like these require that the work be transferred between stations, which, with a standard stationary fixture, must be done by hand. To avoid that delay to production, the automatic rotary indexing fixture shown in Fig. 2 was designed. This fixture has three stations. The two lower stations position two parts for simultaneously roughing and finishing, while the third station, at the top, enables the work to be quickly and conveniently unloaded and loaded during the machining cycle.

At the end of a cycle the table automatically withdraws and the fixture indexes, rotating the new part at the top to the rear station for roughing, the roughed part at the rear station to the front for finishing, and the part that has just been finished at the front station to the top for unloading.

A common problem is that of loading a heavy or unwieldy part on a fixture quickly and conveniently. Often a cradle fixture mounted on horizontal trunnions that can be tipped or swung hydraulically is the answer. Figs. 3 and 4 show such a fixture designed to hold an aircraft propeller barrel, which must be bored and counterbored. In the horizontal position, the part can be easily located over four pins, and clamped in place by four straps. A hydraulic cylinder then swings the fixture cradle 90 degrees to the vertical boring position, where it is rigidly held hydraulically against solid stop-buttons.

A long open hole and a counterbore are bored in line in a single pass by two tools mounted on one

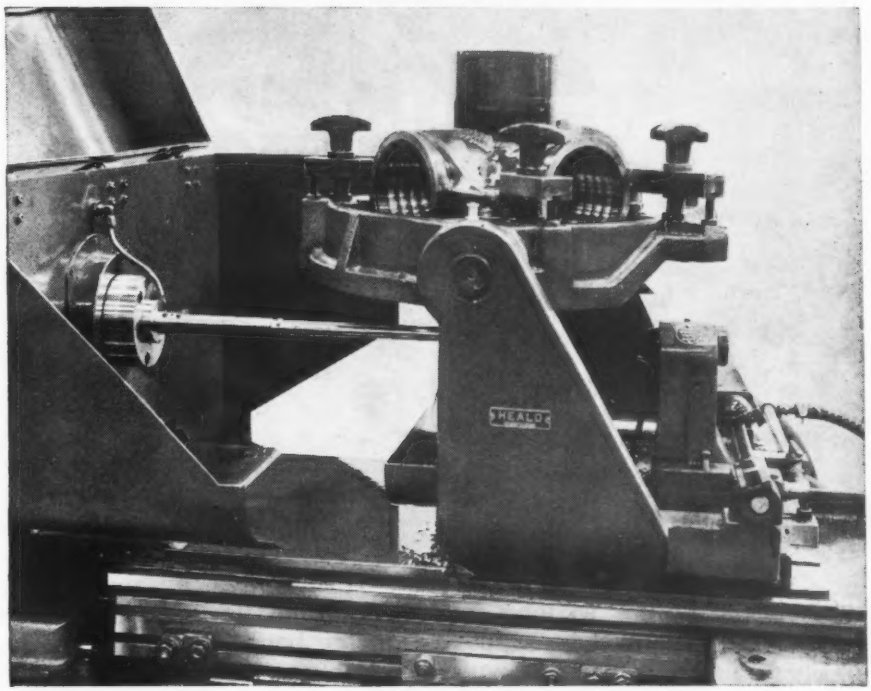


Fig. 3. Propeller Barrel in Horizontal Loading Position of Hydraulically Operated Cradle Fixture

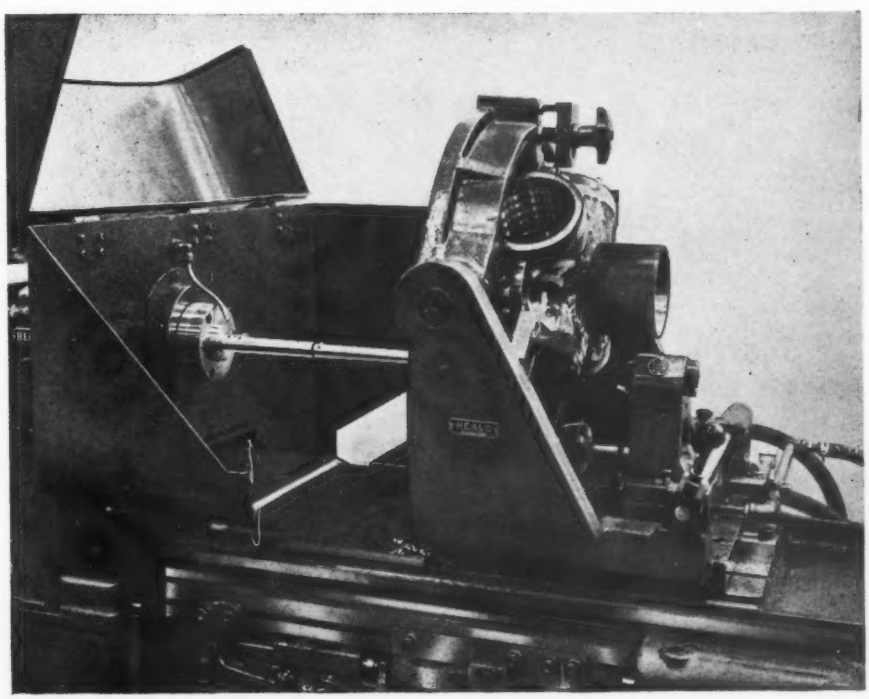


Fig. 4. Propeller Barrel in Boring Position after the Fixture Cradle Shown in Fig. 3 has been Swung Hydraulically 90 Degrees

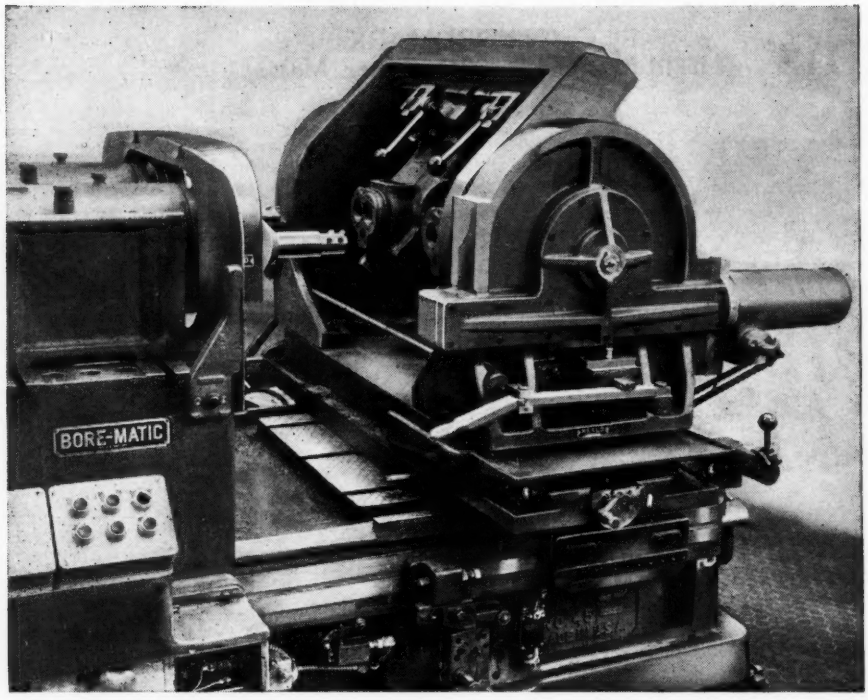


Fig. 5. Tip Type Cradle Fixture in Position for Boring One Bank of Cylinders in Each of Two V-type Four-cylinder Compressor Blocks

quill. This quill is so long in proportion to its diameter that it must be supported during boring by the outboard support shown on the table to the right.

Another use for the tip type cradle fixture is in boring holes that must be in accurate angular relationship, as shown in Figs. 5 and 6. The parts in which the holes are bored are four-cylinder V-type compressor blocks having two cylinders in each bank with axes at 90 degrees to each other. The cylinders in each bank are staggered, and must be rough- and finish-bored.

This cradle fixture has two stations for holding two blocks at one time, which makes possible the finishing of eight cylinders in one setting. The fixture is rotated 15 degrees, which makes loading, locating, and clamping of the part quick and easy. The blocks are located from holes in the flanged foot by two dowels, and are clamped against the bottom face by two straps. The fixture is mounted on a hydraulic cross-slide with barrel stops for indexing transversely between bores.

Two boring heads mounted on the machine bridge are spaced to bore one cylinder in each of the two blocks simultaneously. Each quill carries a tool for rough-boring and one for finish-boring. They are held by hydraulic cross-feed units on the boring-head spindle flanges. The radial movement thus secured retracts the tools at the end of the cut to prevent tool drag lines in the finished cylinders.

The cycle is as follows: After loading, with the cradle tilted at 15 degrees and the fixture cross-slide in the rear position, the cradle is rotated 120 degrees, which aligns one set of cylinder banks with the boring quills. One cylinder in each bank is then bored, after which the fixture cross-slide is indexed forward to the second barrel-stop, which lines up two more cylinders. Boring these cylinders completes the operations on one bank on each of the two blocks.

By rotating the cradle 90 degrees and returning the cross-slide to the first barrel stop, a pair of bores in the other cylinder bank is aligned with the boring heads. When these are bored, the fixture cross-slide is indexed and the remaining two cylinders in that bank are bored. These two examples of the use of the tip type cradle fixture should suggest possible uses for similar methods on a variety of parts.

The job shown in Fig. 8 is more spectacular than difficult. It consists in facing three holes, the faces being at one end of a crankcase and at right angles to the major axis. Chucking the crankcase vertically brings the

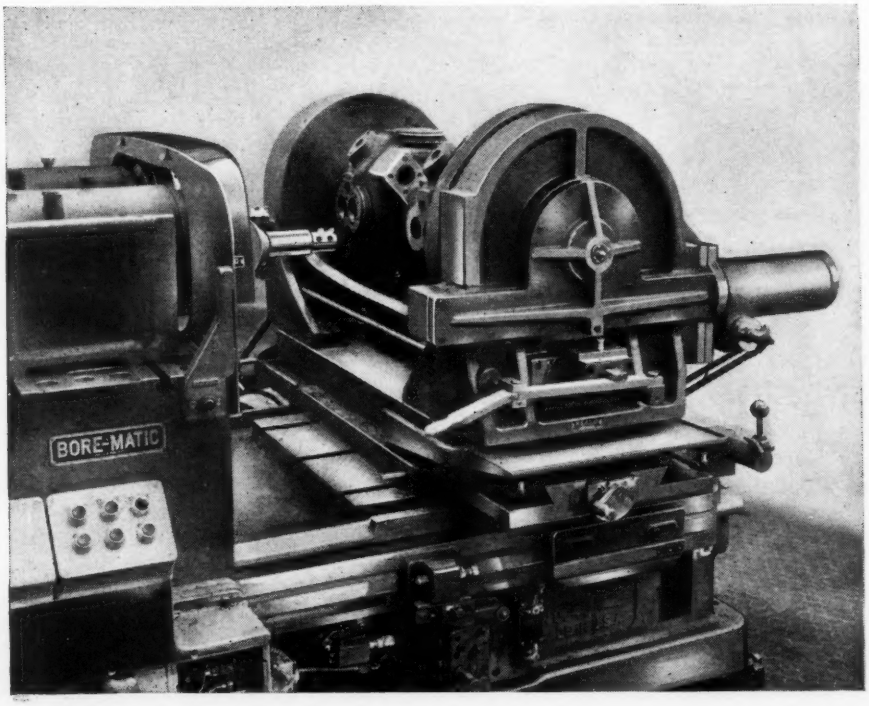


Fig. 6. Same Fixture as Shown in Fig. 5 after the Cradle has been Rotated 90 Degrees for Boring the Second Bank of Cylinders

holes to be faced into convenient location and permits easy loading of the large part by crane.

Double-end mounting of the boring heads permits complete finishing of all faces in a single set-up. Each boring head is equipped with a hydraulic cross-feed unit, mounted on the spindle flange, carrying a single tool which is fed radially while rotating, thus generating very flat and accurate faces on the stationary work.

The crankcase is loaded on a horizontal rotary indexing fixture, resting on the face of the lower section. It is located by three buttons and two dowels, and clamped by three knob-operated straps. The rotary fixture is mounted on a hydraulic cross-slide. The combined rotary and cross indexing makes it possible to perform all three facing operations at one set-up.

The cycle begins with the cross-slide at the rear and the table in the center stop position. The table starts to the left at rapid traverse up to a positive stop, and the cross-feed unit on the rear boring head automatically feeds across and generates one of the faces. The cross-feed unit then retracts and the table automatically reverses to the center position. The fixture and cross-slide are now indexed, the fixture angularly to the second face and the cross-slide forward against the front stop, after which the table again travels to the left, and another face is generated by the cross-feed unit on the left boring head. The fixture is then indexed, and the third face machined by the right-hand head.

The problem posed by the silver-plated master-rod bearing shown in the sketch, Fig. 7, is to straight turn and contour-bore the work at the same set-up in order to maintain close tolerances. The size must be held to less than 0.0005 inch, concentricity to less than 0.0015 inch total indicator reading, and surface finish to less than 20 micro-inches. The bore consists of a straight section at the center and tapers at both ends.

The set-up for this job is shown in Fig. 9. The bearing is rotated in a fixture attached to the boring-head flange, which is mounted on the machine bridge. The fixture locates the bushing from the outside diameter of the flanged section and clamps it against the rear face with three fingers contacting the flange. The fixture is air-operated.

The contour is bored on the table in-stroke, the tool being guided by a cam attached to the right-hand bridge. On the return stroke, the outside is straight turned by another tool. Both of the bars are pivoted to permit positioning and retracting the tools at the beginning and end of both cuts. This is accomplished by a mechanism attached to the right-hand bridge.

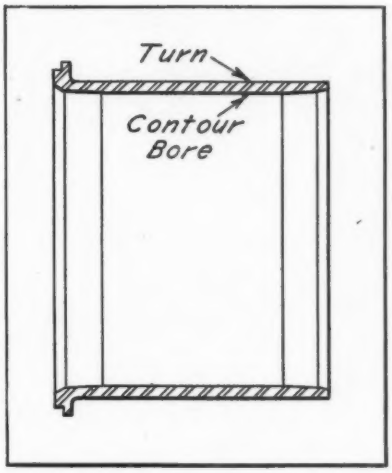


Fig. 7. Silver-plated Master Rod Bearing Machined at One Set-up, as Shown in Fig. 9

To obtain the high surface quality required, the machine is equipped with special units to isolate and decrease the effect of vibration and temperature changes. The machine includes a special boring head, outboard drive, outside hydraulic pump, and tank.

Many modern machine parts must be marvels of precision. When they contain small-diameter holes, the job is apt to be "fussy" in the extreme. Such a job is the fuel injection nozzle shown in Fig. 10, which has a plunger hole only 0.2350 inch in diameter, which must be perfectly round and straight and within 0.0002 inch of size, so that the final lapping will bring the hole to practically perfect size.

The cycle, tooling, and fixtures employed to secure these results are quite ingenious. For greatest accuracy, the stock, amounting to about 0.010 inch, is removed in two cuts. The semi-finish cut is taken on two nozzles simultaneously at the two stations to the left, and the finish-boring is done at the two stations at the right.

The nozzles are rotated by boring heads whose

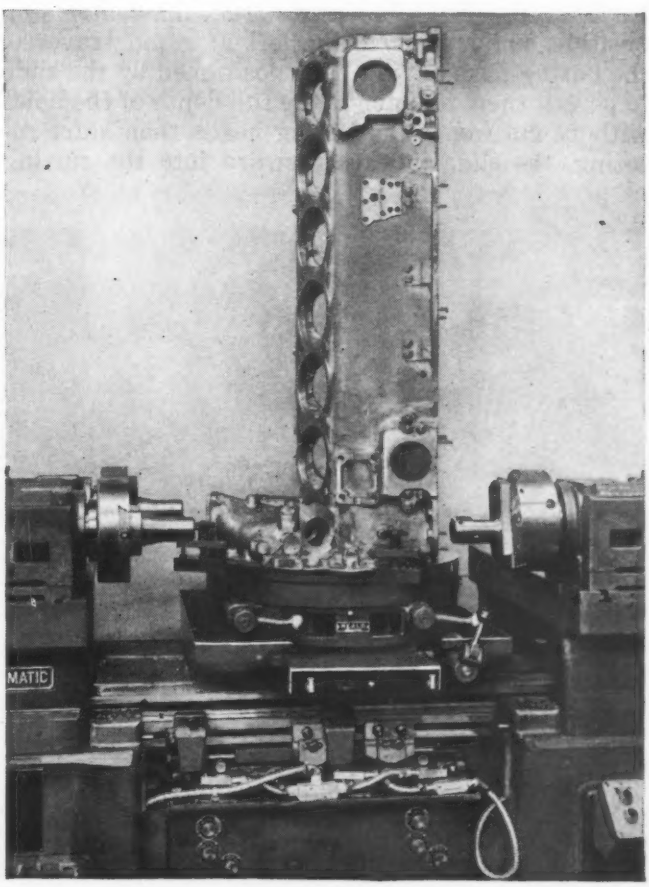


Fig. 8. Facing Three Holes of Crankcase at One Set-up by Mounting the Work Vertically on a Horizontal Rotary Indexing Fixture

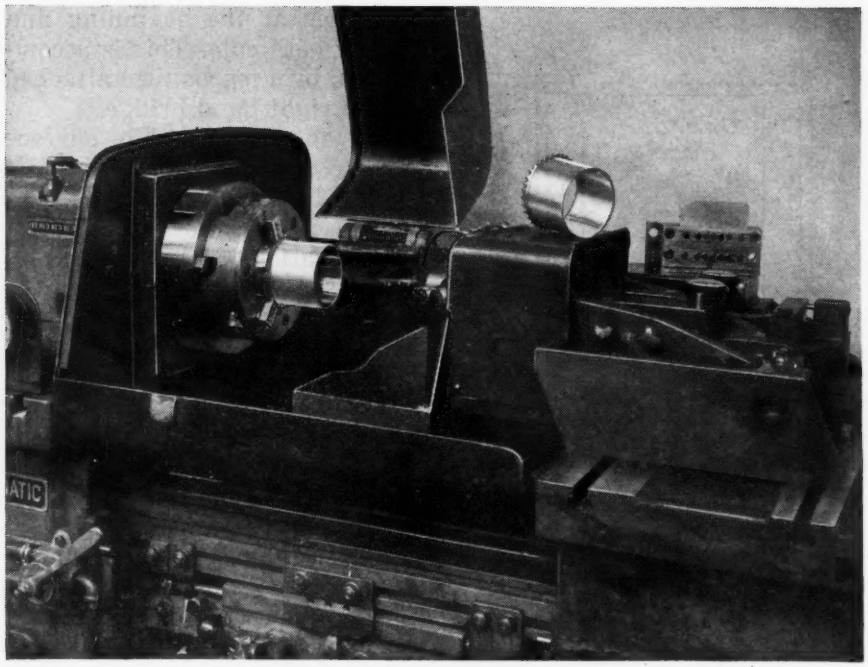


Fig. 9. Straight Turning Outside of Bearing Shown in Fig. 7 and Contour-boring the Part at the Same Set-up

spindle flanges hold rotating, split type, wrench-operated fixtures, which locate the nozzles from the outside diameters. A double-end boring-bar fixture is mounted on a hydraulic cross-slide. The four boring-bars are all of the pivoted adjustable type, equipped with dial indicators for visual tool setting.

To prevent tool drag lines, the plunger holes are back-bored. The table starts from the center stop position and travels to the left at rapid traverse, the boring-bars having been positioned by the slide to permit them to enter to the full depth of the holes without cutting. The boring heads then start rotating, the slide indexes forward into the cutting position, and the table reverses at boring feed.

When the semi-finish-boring has been completed, the table moves at rapid traverse to the center stop position, the nozzles are transferred to the right-hand stations and finish-bored in a similar cycle, except that the slide indexes to the rear. Instead of loading at the center position, it is possible to run the table without interruption to either end and load one end while boring at the other.

When a series of different operations, perhaps including roughing and finishing cuts, must be performed on one or more parts, production can usually be greatly increased by using double-end machines. An aluminum-alloy magneto housing with steel laminations has a series of four different progressive operations performed on it by the four-station, double-end machine shown in Fig. 11.

Preliminary roughing of one end of the housing is done at the left front station by eight tools mounted in a common quill attached to a hydraulic cross-feed unit, which is rotated by the boring head. The surfaces bored are a counterbore and the bottom face, another counterbore and its bottom face, a laminated steel bore, a face which is plunge-cut, another counterbore and face, a 45-degree chamfer, and an open hole. These surfaces are machined as the table moves to the left. At the end of this stroke, the cross-feed unit automatically starts to travel radially, causing an internal annular groove to be cut in the part. When the right diameter is cut, the grooving tool automatically retracts.

After this end of the housing has been roughed, it is finished at the left rear station simultaneously with the roughing cut on another piece at the front left station. Three tools mounted in the quill of the rear boring head finish-bore and bottom-face the front counterbore, bore the steel laminations, and bore and bottom-face an inner counterbore, all in one table stroke. At both left-hand stations, the housings are held in shuttles in hand-operated fixtures attached to the machine table.

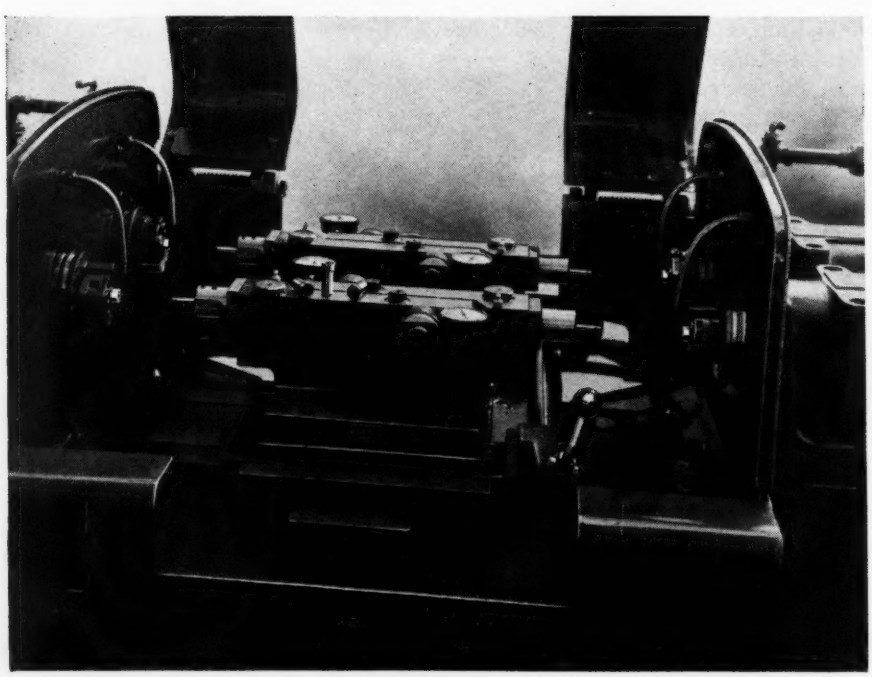


Fig. 10. Semi-finish- and Finish-boring Four Fuel Injection Nozzles at One Set-up

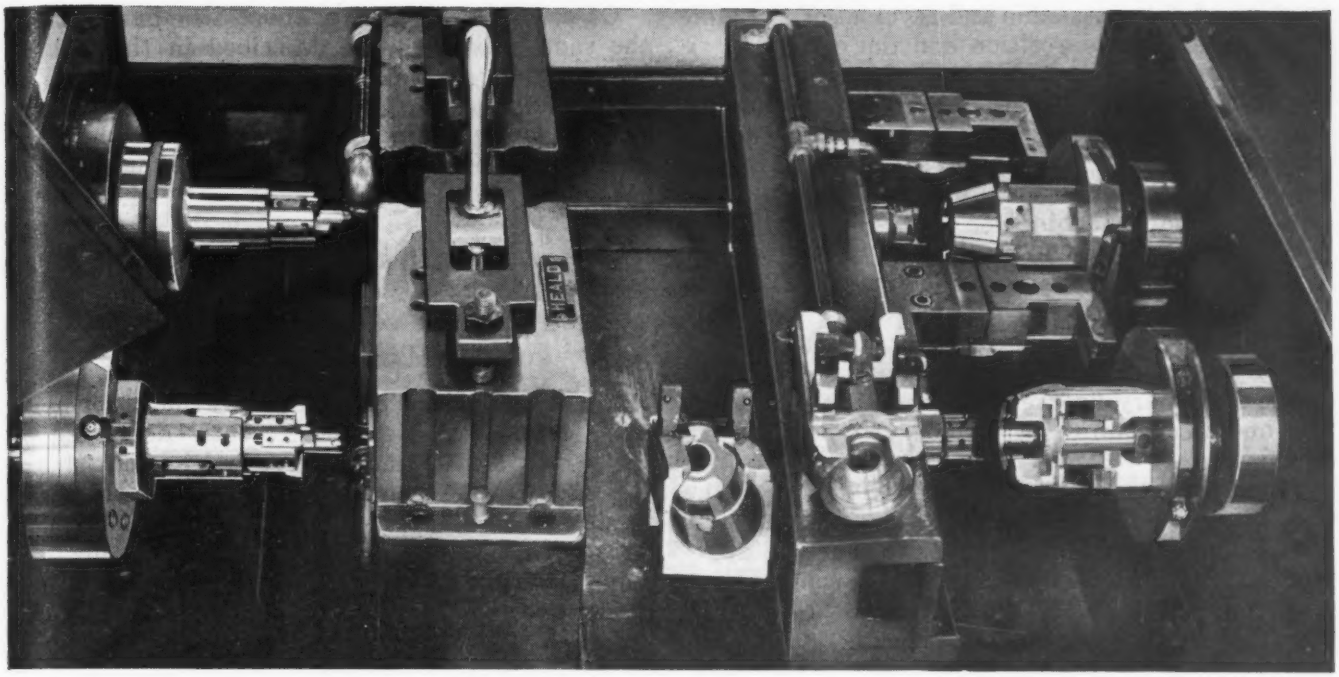


Fig. 11. Aluminum Magneto Housings being Progressively Bored, Chamfered, Grooved, and Faced on a Four-station, Double-end Machine

When operations at the left are completed, the table reverses to an intermediate position and stops for unloading and for reloading the parts at the right-hand stations for operations on their other ends. The fixtures to the right are air-operated, and are rotated by the boring heads.

Initial roughing is accomplished at the rear station by six tools mounted in a common boring-bar. As the table feeds forward, these tools bore and bottom-face a counterbore, bore another section, plunge-face the front of an inner hub, bore the outer wall of a circular groove around the hub, and plunge-face part of the adjacent surface at the bottom.

On completing this movement, the table comes in contact with a positive stop and a hydraulic cross-slide begins a forward traverse, causing a cam on the slide to impart vertical motion to an auxiliary slide on a fixed bridge that carries the boring-bar just described. This vertical movement causes three annular grooves to be cut within the part. The auxiliary slide also skives the hub, the adjacent face at the root of the hub, and a radius on its front edge by means of a form tool.

Retraction of the tools is then accomplished by reverse travel down the negative cam slope, after which the boring-bar is withdrawn from the work by a hydraulic cylinder. Meanwhile the main cross-slide continues its stroke and the faces at opposite ends of the housing are generated by two opposed tools mounted in blocks on the slide.

The same end of an identical housing at the front right station is simultaneously finish-cut, using a tooling arrangement similar to that at the rear station. Finally, the faces on each side of the housing are finished at the front station by opposed tools fed in a generated cut by the cross-slide. Re-

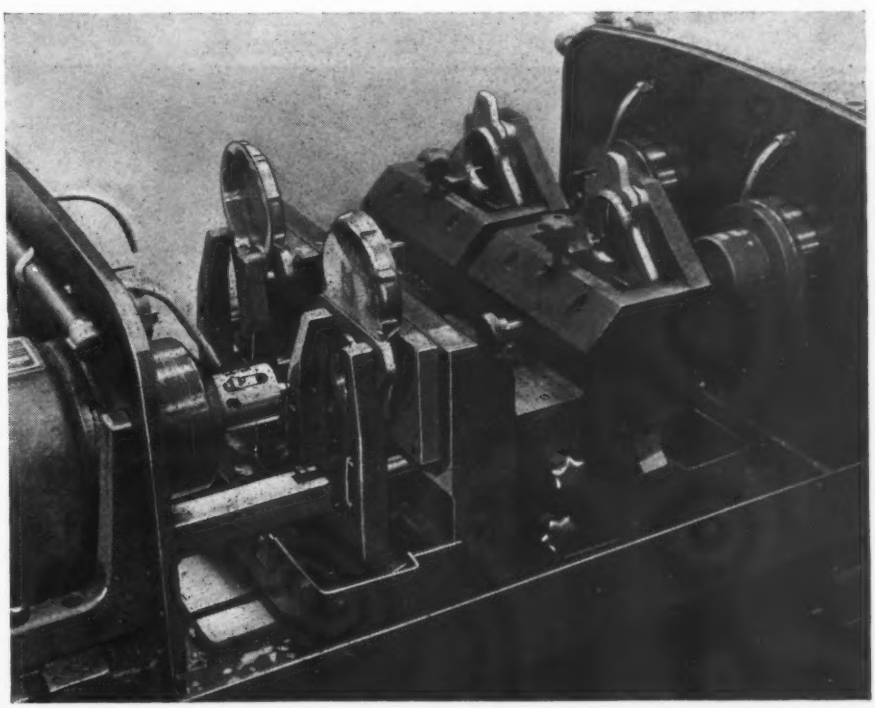


Fig. 12. Magneto Flanges being Machined in Double-end Fixtures Mounted on a Double-end Machine

traction of the cross-slide and reversal of the table to the intermediate position end the cycle.

Sometimes it is desirable to perform progressive operations on a single machine, as, for example, on parts which, because they are out of balance or difficult to chuck, must be held stationary. Such a set-up is shown in Fig. 12, where aluminum magneto flanges are machined on double-end stationary fixtures on a double-end machine.

Operations are accomplished progressively in four stages, but all in one cycle, so that a finished part is removed from the fourth station at the end of every cycle. Two parts are loaded on each side of the stationary fixture, being held by hydraulically operated clamps. The tools are held by the boring heads.

The first operation—roughing one end of the part—is performed at the front right station. It consists of rough-boring a counterbore, plunge-facing the bottom, and plunge-facing a central boss. The same surfaces are finished at the rear right station. At both stations the boring quills each hold two tools. At the third station, left rear, finish cuts are taken directly without previous roughing. Three tools turn a rabbet, chamfer a 45-degree bevel on the rabbet edge, and plunge-cut its front face. Finally, at the fourth station, front left, the last operations are performed on the part with three tools. Two of them bore an open hole and a counterbore, and the third tool cuts an annular V-groove.

The groove is cut by an ingenious arrangement. As the table feeds through the boring stroke the grooving tool is forced radially outward through the intermediary motion of a lever and a contact button on the end of the quill which strikes a latch pin on the fixture. When the groove has been machined to the required size, a fixed latch bracket on the machine bridge releases the fixture latch pin, thus permitting the grooving tool to be withdrawn by spring pressure.

Of course, few, if any, shops will have exactly the same jobs as those described in this article. However, the cases chosen exemplify jobs that have basic resemblances to many others, and it is believed that the principles illustrated by these examples can be widely applied by the exercise of reasonable ingenuity.

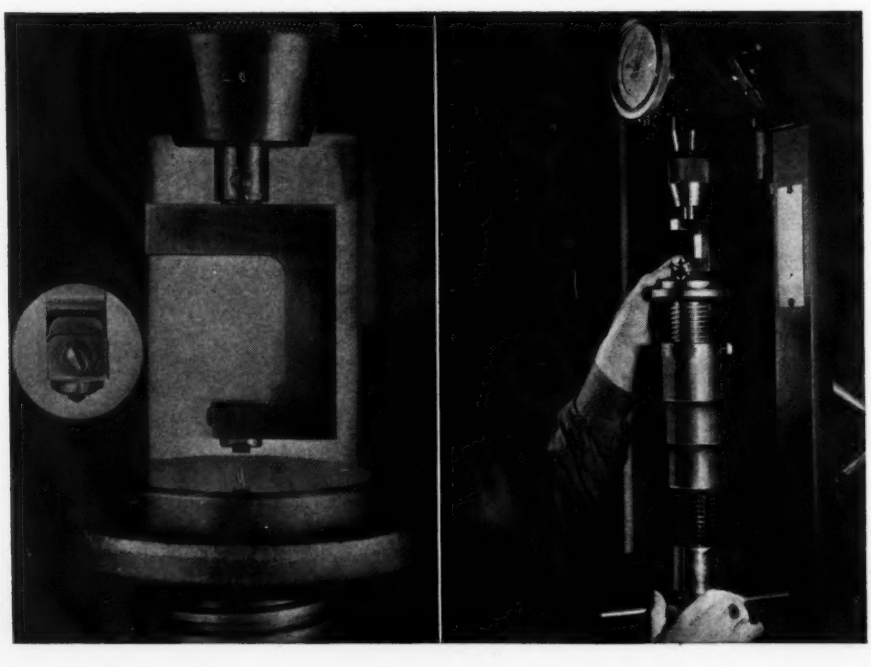
* * *

Application of Cemented Carbides in Hardness Testing

A new application of cemented carbides for hardness testing purposes was recently developed by the Pratt & Whitney Aircraft Division of the United Aircraft Corporation at East Hartford, Conn. For a number of years, solid Carboloy balls have been used in Brinell hardness testing machines, particularly for checking hardness in the higher ranges. The extreme hardness of cemented carbides has insured greater accuracy of hardness determinations.

More recently, however, cemented carbide has made possible the checking of the comparative hardness inside small bores and the checking of the hardness of threads in castellated aircraft engine nuts. The carbide is in the form of an "edge" penetrator, mounted in a C-extension arm on a Rockwell hardness testing machine, as indicated to the left in the illustration. The carbide penetrator has an obtuse angle with a radius at the edge of 0.010 inch. The C-shaped holder is attached to the Rockwell machine as indicated to the right. This arrangement permits the carbide edge to come in contact with the internal threads of the nuts being checked.

The readings obtained with this equipment are relative, and the scale used for comparison is based on readings taken from tests on acceptable and non-acceptable threads.



View to the Left Shows Cemented Carbide "Edge" Penetrator with a 0.010-inch Radius which Permits the Testing of the Hardness of Internal Threads in Nuts. Insert Shows Front View of Penetrator. The View to the Right Shows Test being Made in a Rockwell Hardness Testing Machine

Sound Industrial Relations for Sound Industrial Progress

Abstract of an Address by Louis Ruthenburg, President and General Manager, Servel, Inc., Presented at the Annual Convention of the National Metal Trades Association

MANY Americans believe that the war years were a time of great prosperity. Very few are giving thought to the sobering fact that as we emerge from the war we may be indebted in an amount equal to or exceeding our total appraisable national wealth. If we take into account the value of squandered natural resources, never to be replaced—minerals and depleted farm lands—and the incalculable value of lives lost or rendered ineffective, our losses extend beyond the capacity of imagination.

Nor is it generally understood that since 1929 many of our economic base lines, guide posts, and landmarks have vanished. Before that fateful year, the United States of America had been a self-sustaining, profitable, going concern. Since that time we have, for sixteen long years, been creators of deficits—economic improvisers, recklessly engaged in grand-scale fiscal experimentation.

We hear much talk of "full employment" and of a post-war boom. How much discussion have we heard about how we are going to pay for this most costly of all wars? Let us make no mistake. We must pay the most enormous debt ever created in the world's history with one coin or another. The choice of coin lies between drastically reduced living standards and immensely increased productive efficiency.

Those seem to be the simple, indisputable facts which must be accepted as premises for any discussion of future business practices and industrial relationships.

Modern Industry is Made up of Three Groups

Modern business management is a trusteeship. It holds in trust the interests of three principal groups — consumers, employes, and investors. Failure to serve the interests of any one of these groups will result in injury to the others. Each of the three groups—consumers, employes, and investors—has equal rights; it also has equal power to disturb the balance and to injure itself and its associated groups.

The consumer is the ultimate authority. His money, exchanged for the products and services offered by business, supplies the means of meeting payrolls, purchasing materials, meeting all expenses, and earning profits (if any). The consumer demands sound values according to his own standards. Values are a composite of quality, in the inclusive sense, and price. If quality does not appeal or price is too high according to the consumer's own personal standards, he declines to buy, and no degree of coercion will cause him to buy. Failure of the consumer to buy can deprive employes of their jobs and can cause investors to lose, not only a reasonable return upon their investment, but all invested principal as well. The consumer is the ultimate boss.

The employe rightfully demands the highest real wage consistent with steady employment. He knows that the total annual income is much more important than the hourly rate. He wants good supervision, pleasant working conditions, and recognition as a human being who is an important factor in the enterprise. However, if, under misguided leadership, he demands a wage that results in prices too high for consumer acceptance or causes investors to be deprived of proper safeguards for their investment or of a satisfactory return thereon, he disturbs the balance and may deprive himself of employment.

The investor "holds the bag" and eats at the last table. After all wages and salaries have been paid; after all bills for materials have been paid; after all taxes and other expenses have been taken into account the investor receives some return upon his investment if anything remains. The investor requires two things to induce him to risk his savings to purchase the tools of enterprise. These are (1) safety of his investment and (2) a reasonable return on his investment. If either of these reasonable requirements are not to be had, he is naturally unwilling to invest, and that decision deprives the consumer of goods and services and reduces employment.

The Wheels of Industry Can Cease Turning

During recent years, organized labor has occupied the limelight to the exclusion of consumers and investors. For that reason, many of us have forgotten that the right and power to exert economic pressure by refusing to cooperate does not belong exclusively to labor.

The economic machine can be stalled just as effectively by labor's boss—the consumer—as by labor. Have we forgotten the "buyer's strike" of 1920, when thousands of Americans wore overalls to emphasize their unwillingness to pay inflated prices? Does no one remember the serious unem-

ployment that followed our post-war inflation only twenty-five years ago?

Labor's partner—the investor—has the same right and power to strike and thereby to impede economic progress. Consider the recent news of liquidation of the Higgins Industries. There must be a great many managements in these troubled days that will be tempted to follow the pattern now established by Andrew Jackson Higgins and his associated investors, who choose liquidation of their enterprise in preference to any attempt to continue operations crippled by arrogant, unreasonable labor leadership.

There Cannot be One Law for Employes and Another for Employers

There is an increasing consciousness that something must be basically wrong at the very roots of our national structure, as otherwise these questions would not be raised:

Why are millions of job opportunities being destroyed, even as the universal cry for full employment persists?

Why do we have the anomaly of increasing unemployment and simultaneous labor shortages?

Why this double talk about great wage increases with prices held unchanged?

Why can no stable basis of agreement be reached?

Why can no effective remedial legislation be drafted?

Quite recently an answer occurred to me, and that answer is very simple indeed. We, the people of the United States, are witnessing how the very foundation upon which this republic was erected is being destroyed! A startling and intemperate statement? I think not. Let's face the facts:

The basic precept upon which these United States were founded is this: All men stand equal before the law. Again and again during recent years that fundamental principle has suffered violence and a potent minority has found preference before the law.

Under the National Labor Relations Act, the employer may be heavily penalized for certain unfair labor practices; but that law is completely silent as to unfair practices on the part of labor and labor leaders. That is un-American class legislation. That is un-American and disastrous inequality before the law. Wholly consistent with the spirit of the Wagner Act, the courts of the United States have granted to organized labor "immunity from various provisions of the law affecting monopoly, intimidation, extortion, and riotous assembly."

American labor has repeatedly and conclusively demonstrated its fine patriotism and adherence to American ideals, but labor is being increasingly victimized by the communists' subtle and effective technique of boring from within. Under such conditions "true collective bargaining" is impossible. Shotgun bargaining and collective coercion are the order of the day.

The Remedy — Equitable Legislation Making All Equal before the Law

Let an aroused and informed public opinion demand that the Congress of the United States, once more responsive to the broad public interest as opposed to that of an organized minority, take immediate steps as follows:

1. Revise the Wagner Act, preserving all of labor's equitable rights of organizing for collective bargaining, but balancing every unfair labor practice for which the employer is held responsible by an equally weighted practice for which organized labor must assume responsibility.

2. Enact such legislation as may be needed to rescind all of organized labor's immunities and special privileges under all laws of the land, not excluding anti-monopoly measures, tax laws, and all other laws that apply to business corporations.

Having thus cleared away the rubble, re-established moral values, and reconstructed the foundation of equity, we may proceed with constructive, progressive legislation, with effective agreements, with true collective bargaining, and with law enforcement.

Thoughtful labor, now oppressed or about to be oppressed by monopolistic unions, as well as all other Americans of good will, cannot fail to support this simple and understandable program. Wise labor leaders will support it, if only to avoid the penalties of impending repressive and reactionary legislation.

Unless we thus retrace our path and recapture the moral values we have lost, we shall suffer under flimsy, ineffective, reactionary legislation until chaotic conditions shall have overwhelemed us.

* * *

A proposed Simplified Practice Recommendation for Steel Rivets has been submitted to producers, distributors, and users for consideration and approval, according to an announcement of the Division of Simplified Practice of the National Bureau of Standards. The proposed recommendation, which was developed in cooperation with the industry, contemplates the establishment of a voluntary simplified list of stock production sizes (lengths and diameters) for various types of rivets. Mimeographed copies of the proposed recommendation can be obtained from the Division of Simplified Practice, National Bureau of Standards, Washington 25, D. C.

* * *

Many machine tool users today are giving expression to the idea that, in improving machine tool design, it is not so much a matter of increasing speeds and feeds as of decreasing the handling time of the work being machined. They suggest that, whenever possible, provisions be incorporated in the design of the machine to reduce the handling time.

Electronic Equipment Facilitates Wire-Rope Manufacture

By P. SOMERVILLE, General Manager, and L. R. HUNT, Engineer, Jones & Laughlin Steel Corporation, Muncy, Pa., and J. D. CAMPBELL, Steel Mill Section, Industrial Engineering Division, General Electric Co., Schenectady, N. Y.

WIRE rope used for hoisting and haulage purposes is fabricated in four major successive operations. The individual steel wires are first drawn to the proper diameter in wire-drawing machines. Occasionally the wire is then galvanized, but in any case, the wire comes from the wire-drawing machines in loose, random-wound form.

Following the wire-drawing process, winding machines are employed to wind the wire uniformly from the coils onto bobbins. Several coils of wire are usually wound on one bobbin, the end of each wire length being carefully brazed or welded to the beginning of a succeeding length, so as to form one continuous length of uniform cross-section. A completely wound bobbin may contain wire with a total length varying from several thousand feet to fifty or sixty miles, depending upon the size of the wire and bobbin.

The next step in the manufacturing process is the stranding operation. A previously determined number of fully wound bobbins containing the correct sizes of wire are placed in the stranding machine, which helically "lays" the wires so as to form a symmetric strand of a definite geometric design. This finished strand is wound onto large bobbins, ready for the final operation in which the wire rope itself is formed or closed.

The general practice is to place in the closing machine six or eight bobbins containing wire strands, which are "laid" or closed around a "hemp" rope or independent wire rope center to form the finished product, which is thread-wound onto reels.

Thus, wire rope fabrication consists of the four major steps—wire drawing, wire winding, stranding, and closing. Winding wire on bobbins is a relatively slow but important part of the process—important because properly wound bobbins contribute to the quality of the stranded wire and the ease with which it is stranded. In the plant of the Jones & Laughlin Steel Corporation, Gilmore Wire Rope Division, Muncy, Pa., the wire-winding department winds from 80,000 to 125,000 pounds of wire in a twenty-four-hour day. Taking 0.041 inch wire as the average, well over 4000 miles of wire are wound at this plant in twenty-four hours.

For several years, wire was wound at this plant on group-winding machines. Each of these machines consisted of six winding bobbins and six unwinding "swifts." The bobbins were driven by a constant-speed induction motor through line-shafts, gears, and individual disconnecting clutches. Wire tension was obtained by a mechanical friction brake on the swift, consisting of a snubbing rope around a sheave on the swift.

Obviously, with the bobbins driven at a constant number of revolutions per minute, the wire speed increased as the wire continued to build up on the bobbin. (A gear-changing arrangement for manually keeping the wire speed constant was available, but the arrangement was seldom used.) Thus, in one case, with a few wire turns on the bobbin, the wire speed was 330 feet per minute, and with a full bobbin the wire speed was 800 feet per minute. The average winding speed (with respect to time) was then only about 600 feet per minute.

The disadvantages of the original group-winding machines might be summarized as follows:

1. Low average winding speeds, perhaps 700 feet per minute. The range of wire speeds was from 300 to 1200 feet per minute, depending on the size of bobbin used and the build-up on the bobbin. To wind 4000 miles of wire in twenty-four hours at an average speed of 700 feet per minute required about four groups of machines of six lines each.

2. In recent years, the mechanical maintenance of gears, bearings, and clutches became high. A breakdown on one machine put six lines out of service.

3. With antiquated, manila-rope friction drags on the swifts, uniform winding tension was not

easily obtained. The friction varied, and often ropes would break because of wear. Poorly wound bobbins also resulted in wire breakages and consequent delays in the stranding-machine operations.

The Effect of Adding a Thy-mo-trol Control

Jones & Laughlin then installed four 1-H.P. and four 2-H.P. Thy-mo-trol-controlled wire-winding equipments, thus making a total of eight new wire-winding lines. The mechanical equipment was redesigned so that all gears and clutches were eliminated by operating each line as an individual unit, as indicated in Fig. 1. Each line is now equipped with this particular type of control, and this, together with the redesigned mechanical equipment and the addition of new direct-current equipment, has resulted in the following gains over the old group of wire-winders:

1. Production per line is increased at least three times, largely because of the higher average wire-winding speeds of from 1500 to 2000 feet per minute.
2. The wire speed is maintained constant over the full build-up range of the bobbin.
3. Mechanical maintenance costs are reduced, largely because of the reduced complexity of the equipment.
4. Because of the arrangement of the electric and mechanical equipment, only half the former floor space is required per line.
5. With electric braking at the swift, the wire is wound tighter and more uniformly on the bobbin. This increases the wire weight per bobbin 10 or 15 per cent. Uniform winding also contributes to fewer wire breaks in the stranding machines.
6. Because each winding line is a "packaged unit," a delay on one unit no longer causes delays on the other lines.
7. With the new equipment, limit switches automatically stop each line when a wire breaks or when the rear end of the wire leaves the swift. Thus the operators can devote their time to other operations without watching every line.

Fig. 2 shows in schematic form how this particular equipment has been successfully applied to wire winding. The bobbin motor is rated at 1 H.P., 690 to 1380 R.P.M., 230 volts, direct current, on each of four lines. On each of the other four lines, for winding heavier wire, the bobbin motor is rated at 2 H.P., 1150 to 2300 R.P.M., 230 volts, direct current. Experience has shown that the horsepower rating of the swift motor (which normally functions as a drag generator) should be from one-fourth to one-third the horsepower rating of the bobbin motor.

The success of the method used depends entirely upon the fact that the wire leaves the swift at an almost constant unwinding radius. That is, the loose wire coil is thrown on the swift so that the inner wrap of the coil is "peeled" off the swift at the bottom inside "corner" of the swift core. Therefore, the linear wire speed as it leaves the swift is directly proportional to the number of revolutions per minute of the swift. With this fact in mind, it will be seen that the swift generator serves two distinct functions:

1. By loading the swift generator armature on a variable-braking resistor, a means is obtained of changing the wire tension.
2. With a fixed shunt field setting on the swift generator, the voltage from the swift generator will be very closely proportional to the wire speed (or revolutions per minute of the swift).

Thus, the swift generator is made the means of controlling wire tension and indicating wire speed.

The bobbin motor armature voltage and shunt field are under the control of the electronic equipment to be described. The control is essentially a speed regulator on the bobbin motor, which keeps the wire speed (as indicated by voltage *X–Y*, Fig. 2) practically constant. With the wire at full running speed, and with the bobbin having only a few wraps of wire, the bobbin motor will have full armature voltage and a weak field setting. As the bobbin builds up, the wire speed will tend to speed up, and thus increase the voltage at

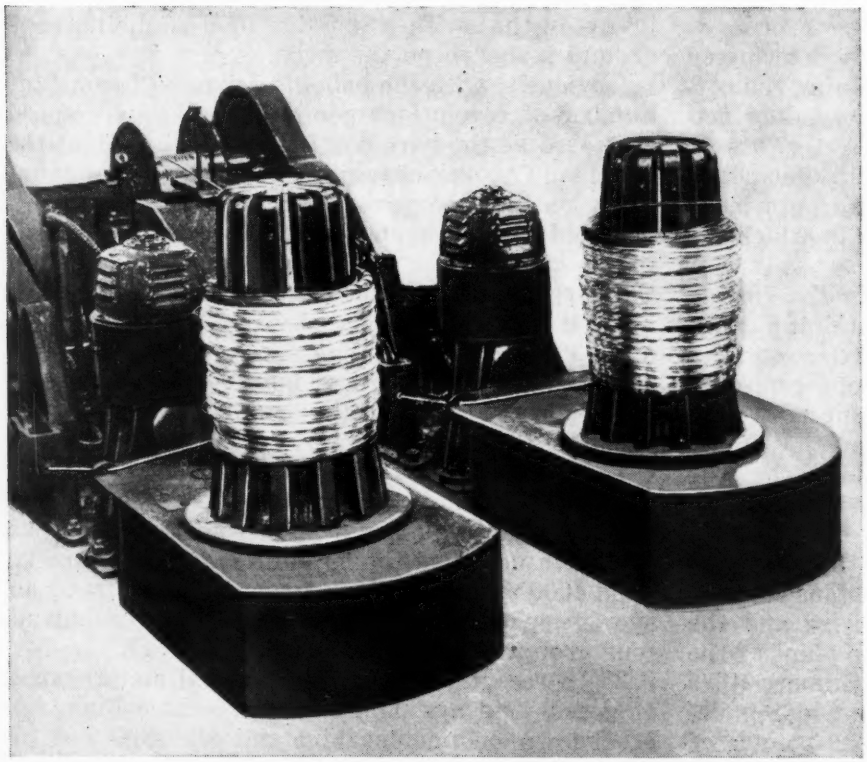


Fig. 1. View of Unwinding Swifts, Drag Generators, and Bobbins for Winding the Wire

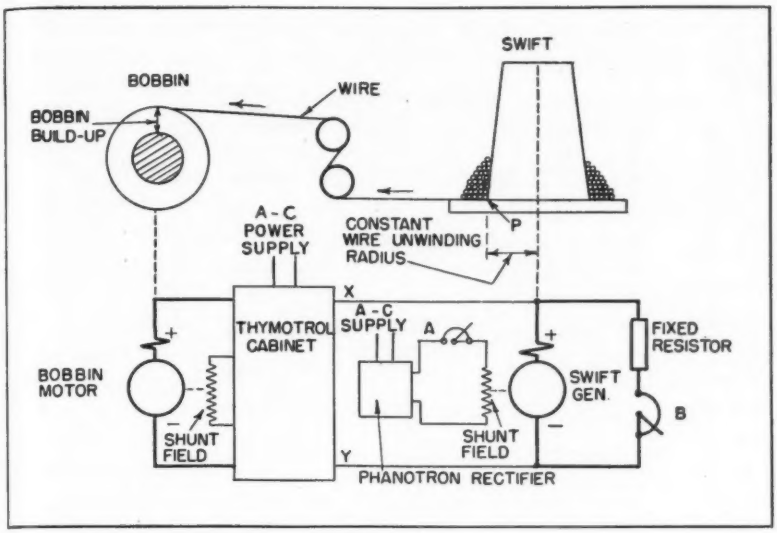


Fig. 2. Wiring Diagram Showing Armature Circuit

X–Y. The speed regulator action will tend to maintain voltage *X–Y* constant, however, by slowly strengthening the bobbin motor field. With full build-up on the bobbin, the bobbin motor will have practically full field, and the wire speed will be the same as with the empty bobbin. Therefore, it is now possible not only to operate at higher wire speeds than were formerly used, but also to hold the wire speed constant throughout the full bobbin build-up.

One other pertinent thing is shown by Figs. 2 and 3. A shunt generator, with constant shunt field strength and loaded on a braking resistor, will have a braking torque roughly proportional to the square of the feet per minute speed of the wire or the revolutions per minute of the swift. This condition is of no great consequence in this application, because for any given wire speed the braking torque will be constant. Thus, wire tension is constant throughout the winding period, for the speed always comes up to the full running value.

Such an arrangement as indicated by Fig. 2 will hold the tension during the infrequent accelerating and decelerating periods. However, the tension may vary considerably from the normal running value without any disadvantages, such as wire breakage. Acceleration of the bobbin motor is under current limit control with the wire under tension. Deceleration and stopping are obtained by dynamic braking of the bobbin motor, with the bobbin overtaking the swift, so as to hold the wire tension within reasonable limits. There are compensating factors, such as variations in stored mechanical energy, friction, and rate of acceleration, in which satisfactory acceleration and deceleration of each line is obtained.

Simplicity of Operation

The operator has only a few adjustment and control devices to which he must pay attention. These include a "slow" button to bring the bobbin to a creep speed for slowly taking up any slack wire after two ends of different wire lengths have been brazed together at a near-by bench; a "fast" button to accelerate the bobbin and swift to full running wire speed, with current limit control of the bobbin motor; a "stop" button to dynamically brake the bobbin motor; an adjustable braking rheostat *B*, Fig. 2, for changing wire tension with different wire sizes; and a small rheostat *A* for compensating for different swift core diameters. Usually the rheostat remains in one position.

The Speed Regulator

Except for details in the control unit, the cabinet of this equipment is a standard, non-reversing, armature- and field-control arrangement, with current-limit and dynamic-braking features. The control unit is slightly off standard in that the speed-regulator feature is included, as shown in Fig. 4. Details have been omitted in the illustration.

To explain the speed-regulator operation completely, Fig. 5 has been included, even though this is the standard single-phase method of furnishing direct-current power to either the bobbin motor field or the bobbin motor armature. While separate thyratron tube circuits are used for field excitation and armature power supply, Fig. 5 applies to either circuit. Generally speaking, only one anode transformer is used for the bobbin motor field and armature circuits.

The grids of thyratron tubes *A* and *B* are controlled by the grid transformer, so as to raise or lower the direct-current output voltage from the circuit in Fig. 5. The primary of the grid trans-

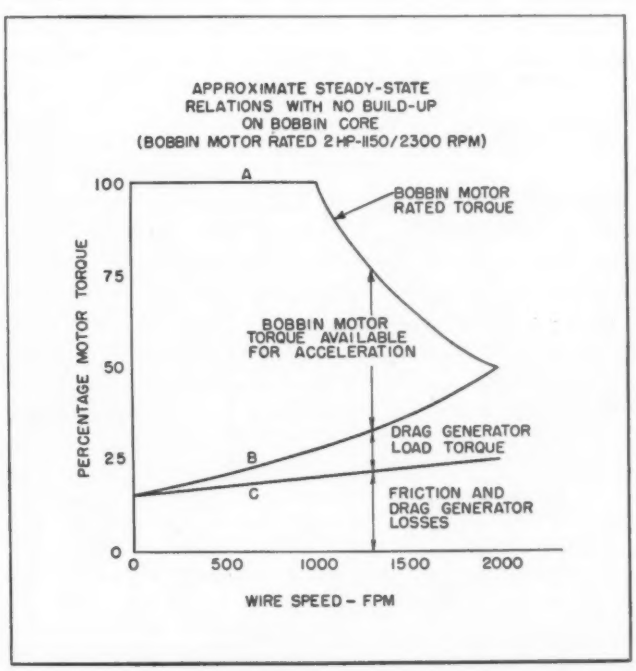


Fig. 3. Bobbin Motor Torque when Using an Armature Circuit-breaking Resistor

former is connected in a bridge circuit which includes the primary winding of the tube filament transformer, the alternating-current windings of a saturable core reactor *FSA* (or *ASA*), and resistor 1. The alternating-current winding of the saturable core reactor has two windings in parallel. The direct-current winding controls the degree of saturation of the iron core, and thus the reactance of the reactor. If the current in the direct-current winding is increased, the bridge circuit will be altered in such a way as to enable the grids to fire each thyratron tube earlier in the positive half cycle of the anode voltage. The direct-current output voltage from the tube circuit will thereby be increased. Similarly, a decrease in the current in the direct-current winding of the saturable core reactor will have the effect of lowering the direct-current output voltage from the tube circuit.

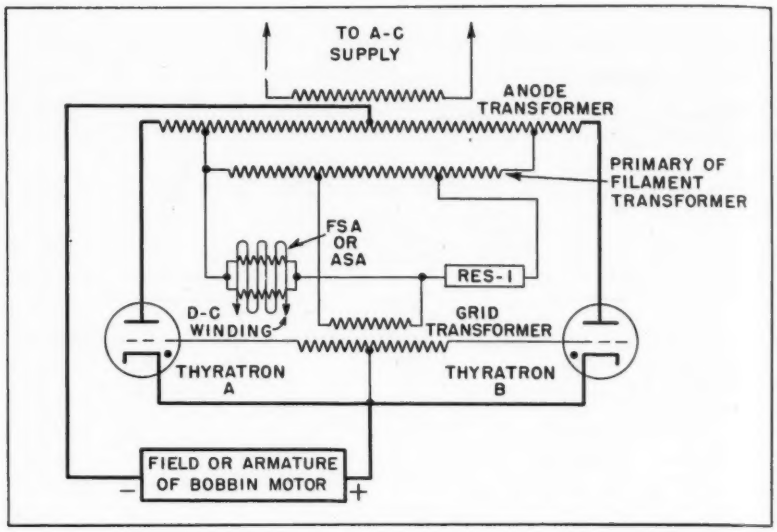


Fig. 5. Bobbin Motor Shunt Field Excitation Circuit or Armature Circuit

Saturable core reactor *FSA* thus controls the grids of the thyratrons used in the bobbin motor field excitation circuit. In a similar manner, saturable core reactor *ASA* controls the thyratron tubes in the bobbin motor armature circuit. A simple way in which to remember the operation of *FSA* and *ASA*, is to consider this analogy:

1. The direct-current winding of saturable reactor *FSA* can be looked upon as being (in effect) the shunt field of the bobbin motor. Increasing the direct current through *FSA* will strengthen the bobbin motor field and lower its speed. Decreasing this current will raise the bobbin motor speed.

2. The direct-current winding of saturable reactor *ASA* acts somewhat like the field of a shunt generator supplying power to the bobbin motor armature. Thus, increasing the direct current through *ASA* will raise the "generator field," and thereby raise the voltage on the motor armature. Likewise, lowering the current through the direct-current winding of *ASA* will lower the bobbin motor armature voltage.

With this analogy available for explanatory purposes, Fig. 4 shows the essential parts of the speed regulator. The swift generator armature voltage at *E1* is the wire speed indication, while voltage *E2* becomes the standard to which the indicated speed is "matched." When *E1* is sufficiently below *E2*, tube *D* will be rendered relatively non-conducting, so as to lower the current through resistor 2. Because of the reduced *IR* drop in resistor 2, the grid of tube *C* will become relatively positive, increasing the current through *ASA* and raising the armature voltage and speed of the bobbin motor. Any tendency for voltage *E1* to go too high will have the opposite effect, in that the armature voltage on the bobbin motor will be decreased.

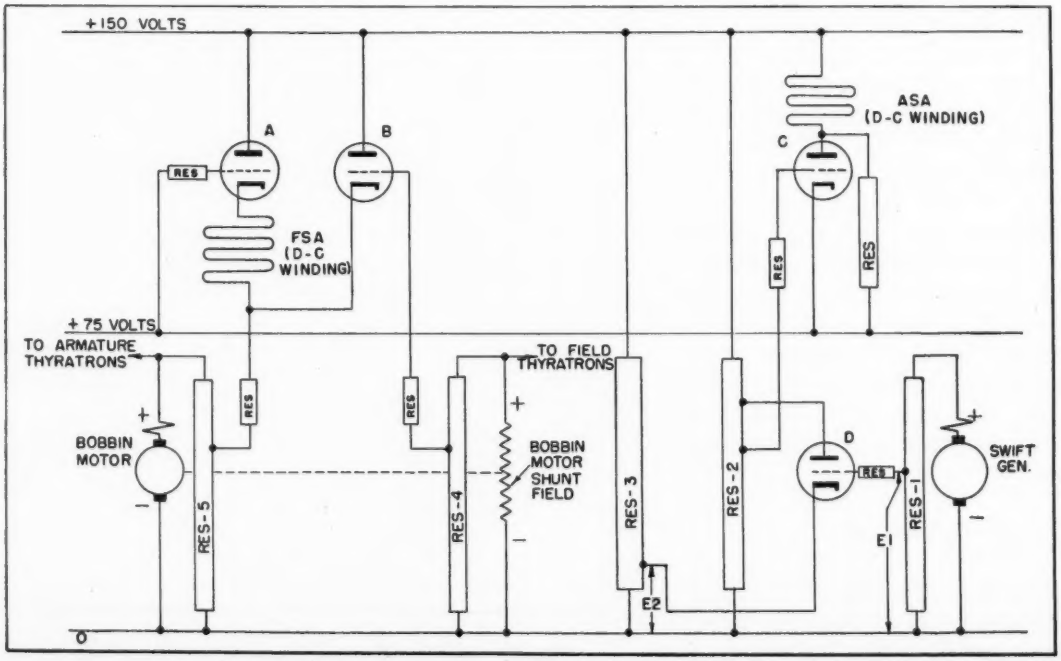


Fig. 4. Diagram of Principal Parts of Thy-mo-trol Control Unit

So far we have considered only the manner in which the speed regulator manipulates the current in *ASA* so as to control the bobbin motor armature voltage. Actually, the speed regulator also begins to

change the bobbin motor field by changing the current in *FSA* after the bobbin motor armature voltage has reached about 210 volts.

With the bobbin motor armature voltage at about 210 volts, slight increases in armature voltage will raise the cathode potential of tube *A* (Fig. 4), so as to decrease the current in *FSA* and further speed up the bobbin motor. A decrease in bobbin motor armature voltage will lower the cathode potential of tube *A*, increasing the current in *FSA* and strengthening the motor field. Thus, it can be seen that below 210 volts the speed regulator operates on armature voltage, and in the overlapping range of from 210 to 230 volts, it operates on field current. Tube *B* limits the maximum voltage on the bobbin motor field by effectively shunting *FSA* when the motor field voltage exceeds 230 volts.

There has been much ingenuity used in the arrangement of the mechanical and electric parts of each line. The new control has been mounted directly above each line, so that no floor space is required for it. The lines are also side by side, running parallel to each other. These features have contributed to the 50 per cent saving in floor space over the previous group drives.

* * *

Annual Meeting of the Society of Automotive Engineers

The annual meeting of the Society of Automotive Engineers will be held at the Book-Cadillac Hotel, Detroit, Mich., January 7 to 11. A great number of sessions relating to almost every phase of automotive engineering will be held. Among the papers of general engineering interest may be mentioned "Substitutes for Tin in Automotive Vehicles," by C. E. Heussner, of the Chrysler Corporation; "Methods for Specifying Materials," by J. L. McCloud, of the Ford Motor Co.; "New Synthetic Lubricants," by J. C. Kratzer, of The Linde Air Products Co., D. H. Green, of the National Carbon Co., and D. B. Williams, of the Carbide and Carbon Chemicals Corporation; "Air Fixtures and Air Controls," by S. Johnson, Jr., of the Bendix Westinghouse Automotive Air Brake Co.; "Latest Developments in Honing Techniques," by L. S. Martz, of the Micromatic Hone Corporation; and "Engineering the Involute Spline," by G. L. McCain, of the Chrysler Corporation.

* * *

Portable Central Coolant System

A new portable central coolant system known as "Strainco," which is designed to serve as an auxiliary tank or as a central system for one or several machines, has been developed by the Strainer Products Corporation, 75-77 N. Willow St., Montclair, N. J. A high-pressure centrifugal pump is mounted on the five-gallon tank with which the unit is equipped, providing an adjustable flow of coolant, varying from a trickle to a steady stream.

Reproducing from Patterns or Templets by Electronic Control

Automatic control of the operation of machine tools is made possible by an electronic contouring control system that has been developed by the General Electric Co., Schenectady, N. Y. Almost anything that can be cut with a motor-driven tool from a pattern or templet can be produced automatically with a machine utilizing this device.

A vital part of this control device is an electronic finger, or tracing stylus, which feels its way along the curves and angles of a pattern, thus controlling the operation of the cutting tool. Two separate direct-current voltages are produced by the electrical circuits. Each voltage determines the speed of one of two feed motors. These voltages are so coordinated that the resultant speed of the stylus around the templet is constant, regardless of the direction.

When a change in contour is encountered, one motor will automatically slow down or speed up just the proper amount to reproduce on the piece of work in the machine the contour on the pattern. If a 90-degree angle is encountered, the direction of pressure on the stylus and the direction of motion of the tool are changed by 90 degrees almost instantaneously. Either an inside or an outside angle can be cut in this manner. It is impossible for the stylus to stray away from the templet, thus insuring not only a constant degree of accuracy in pattern reproduction, but a continuous cutting operation on the most complicated parts.

The rapid changes in direction of machine motion are dependent on fast motor control. So sensitive is the thyratron tube control of the motors, that each can be stopped or started in less than one-eighth of a second. By merely pushing a button, an operator can release the automatic control and take over the operation of the machine himself. With this method, the speed, direction, and control of the motors are handled by the operator through a system of push-buttons and dial controls on the master panel.

There is no danger of overcutting the pattern, even manually, for when the stylus touches the pattern, the automatic control is brought into action, and follows the templet until the operator again takes control. This manual operation is particularly advantageous in following an outline drawing instead of a cut-out templet. The operator can then direct the tracing stylus over the drawn diagram in pencil fashion, and the motors will take care of moving the machine to follow the stylus.

* * *

Everybody from the President down talks about full employment. Very little, however, is said about removing all obstacles to full industrial and agricultural production. Were the barriers removed that now hold back individual enterprise, so that full production could be achieved, full employment would take care of itself.

Standardization of Electrical Equipment for Machine Tools

Abstract of a Paper Read before the Annual Meeting of the American Society of Mechanical Engineers, Covering the Standardization Work Carried out to Facilitate the Application of Electrical Equipment to Machine Tool Design

By R. H. CLARK, Electrical Engineer
Warner & Swasey Co., Cleveland, Ohio

MECHANICAL and electrical engineers working on machine designs have been severely handicapped in the past through the lack of proper standards to guide them in their work. The National Electrical Code was entirely inadequate, and other design standards were scattered through so many publications that they were not usable. Recognizing these facts the machine tool industry appointed an electrical committee to prepare minimum standards and application infortion for the guidance of mechanical and electrical designers.

The first publication of the Machine Tool Electrical Standards, ASA C-74, appeared in June, 1942, as a War Emergency Standard. In July, 1942, the War Production Board made the use of these standards mandatory for machine tool builders and users, to facilitate the mass production of machine tools during the war. This action eliminated the many and varied special requirements of certain large users, but it did not convince these users that their special ideas should not be incorporated in post-war machines.

Rather than go back to the pre-war conditions of many individual user's electrical specifications, with the resulting confusion and high manufacturing costs, the Machine Tool Builders' Electrical Committee undertook to revise the C-74 standards to more nearly conform with the large users' requirements and to serve as a more complete guide for the machine designer.

For the last two years, this work has been carried on with the cooperation of a Joint Industry Committee representing the large users of machine tools. This committee includes representatives of most of the large automobile manufacturers and many other industries in the Detroit area. This Joint Industry Committee has also standardized the special electrical requirements for machine tools used in mass production industries, and eliminated most, if not all, of the twenty-five sets of users' specifications previously in use.

The main problem of the two committees working together has been to bring the C-74 standards and the Automotive Standards into agreement as far as possible. This has been done to the extent that there are now only twelve points of disagreement in the more than one hundred paragraphs included in the standards.

For the convenience of engineers, the publication "Machine Tool Electrical Standards for General Industry" includes those paragraphs of the Automotive Standards which are not in agreement. In due course, it is expected that the General Industry Standards, with minor modifications, will become the revised C-74 standards. The General Industry Standards also contain some recommended practices which are considered good engineering practice, but which would create undue hardship on some builders if made mandatory at this time.

The following is an outline of the major points covered by the General Industry Standards, with mention of the Automotive Standards where they are in disagreement.

Requirements Concerning Wiring Diagrams

The machine tool builder is instructed as to what type of diagram is to be supplied and how many copies are to be furnished to the user. The builder is required, further, to use American standard symbols and to provide an elementary diagram and schematic sequence of machine operations on all but the simplest apparatus. On large machines requiring a special foundation, the size, purpose, and location of the conduit and incoming lines must be shown on a print specially prepared for the purpose.

Standardized Controls

All controls, whether purchased or manufactured by the machine tool builder, shall be American Standard for such equipment. The Automotive Standard limits the minimum motor starter to NEMA Size 1 starter for double protection against any electrical or mechanical failure.

For many years, the disconnect switch, or circuit-breaker, for the branch circuit supplying power to the machine tool was considered the responsibility

of the user. This apparatus now becomes the responsibility of the machine tool builder on all but small, bench type machines powered by a single motor rated 2 H.P. or less. A recommended practice states that the disconnect switch, or circuit-breaker, should be made a part of the control panel and should be interlocked with the control enclosure door.

Overload protection for each motor shall be supplied, except in the case of short-time rated motors. Furthermore, under-voltage protection shall be provided for all motors that might cause damage or injury if they should start after interruption and return of power. Proper interlocking of the control is also specified to insure proper functioning of the machine.

Through the work of the original Electrical Committee of the National Machine Tool Builders' Association, the National Emergency Code was revised to permit grouping all the motors and controls for one machine under the protection of one branch circuit over-current device. A limitation of approximately 25 H.P. for the total machine horsepower was set at that time as a safe figure, and certain construction features for the enclosures for the control equipment were required to minimize any fire or injury hazard in case of a short circuit.

In view of the greatly increased horsepower used on present-day machine tools, it is now believed that the limitation should be raised to approximately 50 H.P. per machine, and that certain changes should be made in the specifications of the enclosure for added protection to the control equipment. Final approval for such changes rests with the National Emergency Code authorities, and the necessary steps are now being taken to determine whether the larger ratings can be safely used.

A sub-division under the control heading covers in some detail the construction and location of the enclosure for the control and recommends that all control devices for any one machine be mounted in one enclosure instead of in several enclosures at different locations on the machine.

Some Points of Difference from the Automotive Standard

The Automotive Standard differs from the General Industry Standard in that further precautions are required to give added protection to the control equipment. The Automotive Standard specifies that all enclosures for special controls shall have hinged covers which swing horizontally, and shall be held closed by screws or bolts which require the use of a tool such as a screwdriver or wrench to remove. The General Industry Standard agrees except on the means for holding the door closed.

As a recommended practice covering the mounting of control equipment, the General Industry Standard specifies that all terminals and parts of devices normally serviced or inspected on control equipment should be mounted not less than 8 inches above the floor line of the machine. The width and height of the control panel should be at least 1 inch less than the corresponding width and height of the door opening, and the depth of the control compartment should be a minimum consistent with the maximum depth of the device plus the required electrical clearances. Furthermore, no portion of the machine immediately above the door opening and less than 6 feet from the floor should project more than 6 inches beyond the door frame.

The Automotive Standard requires that when the control enclosure is mounted on the machine, the bottom of the enclosure shall be 2 feet or more above the floor. When separately mounted, the user will mount the enclosure at the desired height.

The location and type of limit switches and push-button stations are specified to insure trouble-free operation and promote safety in the operation of the machine.

In the construction of control panels, it is required that all front-connected devices shall be removable from the front of the panel without the necessity of removing the panel from the enclosure. The method of identifying the wires and the use of terminal boards are covered for ease in servicing the equipment.

Proper marking of coils, the rating of motor starters for jogging or inching duty, and the number of poles for disconnect switches and motor starters are covered by the section on the type of control.

Requirements Pertaining to Motors

The General Industry Standard requires that the purchaser shall specify the type of motor enclosure desired, and that all alternating-current motors of 1/4 H.P. and larger should be operated on polyphase power. The type of motor—that is, whether special or standard—is not limited.

The Automotive Standard requires that all motors shall be totally enclosed, or totally enclosed, fan-cooled. The use of special motors, such as flange-mounted, shaftless, geared, or NEMA rerated frame, must be approved in writing by the user before they can be furnished on the machine of the builder.

The General Industry Standard requires only that in the mounting of the motor, the motor hold-down bolts shall be easily removed and replaced and the conduit boxes easily reached; whereas, the Automotive Standard requires space for a motor of the next larger size if motors are mounted inside the machine tool. If these conditions cannot be met by the builder, it is necessary for him to furnish a motor mounted outside of the machine and to provide space for a motor one size larger than the maximum horsepower recommended by the machine tool builder.

Both standards are in agreement that all motor compartments must be clean, dry, and adequately vented directly to the exterior of the machine, and that protection against dirt and chips must be adequate to prevent trouble from this source. If a conduit or pipe is run into the motor compartment

from a dirty section of the machine, all clearances around the conduit or pipe must be sealed.

It is further required that all motor nameplates must be visible, or a plate with duplicate information provided where it can readily be seen. The nameplate must not be removed from the motor.

Wiring Requirements

Current capacities of wires external to the control panels shall be furnished in accordance with the National Emergency Code, except that to meet the Automotive Standard, this wiring shall be large enough for the next larger horsepower motor.

No splices are permitted in control wiring, and all splices in power wiring must be covered with varnished cambric, or oil-resisting synthetic tape, and given an oil-resisting treatment.

The use of an oilproof insulating compound on wires is required where subject to oil, coolant, moisture, or vapor, and for a 110-volt circuit, an insulation of 1/32 inch thickness may be used. The Automotive Standard requires that a minimum thickness of 3/64 inch insulation shall be used at all voltages, and this provision has been adopted as a recommended practice in the General Industry Standard.

A recommended color coding scheme for wiring is specified to agree with a proposed color coding scheme of the electrical industry.

It is recommended that 110 volts be used on all control circuits on alternating-current powered machine tools, and for the automotive industry this is mandatory. The means of obtaining and the proper protection of these circuits are specified.

Conduit and Raceways

Under the subject of "Conduit and Raceways," it is required that all stationary machine wiring shall be totally enclosed in heavy wall conduit, conduit fittings, and junction boxes, or sheet-metal boxes. General-purpose flexible metal conduit may be used where it is necessary to employ flexible connections for small or infrequent movements, provided that it is not subject to oil or moisture. Wiring connections to continuously moving parts of a machine shall be in an approved type oil-resisting, extra flexible, non-metallic covered cable or in a liquid-tight flexible conduit with extra flexible conductors.

Compartments or raceways within the column or base of a machine may be used to enclose wiring, provided that such compartments or raceways are isolated from coolant and oil reservoirs, are entirely enclosed, and conform with the National Emergency Code. A clearance of 1 inch must be provided between such conductors and any moving mechanical parts, or suitable barriers must be provided. Junction boxes shall not have extra knockouts, and shall be provided with gasketed covers to make them oil- and water-tight.

The Automotive Standard agrees with these specifications, except that no general-purpose flexible metal conduit may be used for any purpose, liquid-tight conduit being required where small or infrequent movement of the apparatus is involved.

Provisions Specified for Grounding

Both standards require that all control cabinets, motors, metal conduits, control stations, and other devices where there is a possibility of contact with current-carrying parts shall be grounded. This grounding may be made by attaching the device to the machine tool with bolts or other approved means if all of the paint and dirt is removed from the joint. It is the responsibility of the user to ground magnetic control equipment not attached to the machine and to ground the machine.

A provision for exposed grounded control circuits of 24 volts or less is made to permit certain gaging operations, but only where a complete description of the circuit and the reason for its application are given the user and his approval obtained.

The General Industry Standard requires that where an auxiliary device must be removed under certain operating conditions, it may be connected through a plug and receptacle, or a junction box provided with a terminal board, if a grounding connection is included.

The automotive industry does not consider it safe to use a plug and receptacle, a terminal board being required on all such installations.

If a plug and receptacle is used on a machine tool, it must be of the locking type to prevent accidental disconnections, and it shall be provided with a gasket to prevent the entrance of oil or moisture when in operating position, as well as with means for effectively sealing the receptacle whenever the plug is removed.

Limit switches located in various places on the machine tool shall be identified with the same markings used to identify them on the wiring diagram, to facilitate servicing. If any device is removed from its enclosure, it is required that a nameplate be put on such device to completely identify it.

Copies of the Machine Tool Electrical Standards for General Industry, including the Automotive Standards, may be secured from the National Machine Tool Builders' Association, Cleveland, Ohio, and copies of the Automotive Standards alone may be secured from any of the automobile manufacturers in the Detroit area.

Although these standards apply particularly to the electrification of machine tools, it is believed that they represent sound engineering practice for any machinery operating under conditions similar to those under which machine tools operate.

* * *

A questionnaire sent to home owners indicates that six of the eight items that will be most in demand in post-war homes, when again available, are electric in character. They are electric irons, kitchen ranges, refrigerators, radios, vacuum cleaners, and washing machines.

Using Diamonds for the Crush-Forming of Grinding Wheels

By HARRY L. STRAUSS, Jr.
National Diamond Hone & Wheel Co., New York

CRUSH-FORMING of grinding wheels provides a method by which irregular shapes and forms on grinding wheels can be quickly and economically produced and the form can be reproduced as often as required. The present article will describe a new method of crush-forming—new in that diamonds instead of steel crushing rollers are used. In the example to be described, two 90-degree V-shaped ridges were to be ground on a flat piece of hardened steel, 1/4 inch between centers, as shown in Fig. 1.

To form the grinding wheel, two small diamonds with 90-degree cone-shaped points were used. These tools were clamped in a fixture so that the points of the diamonds were 1/4 inch apart. A surface grinder was used for the crush-forming operation, the wheel speed being slowed down to about 10 surface feet per minute. The diamonds were then fed slowly toward the wheel until there was actual contact, the pressure being continued until the grooves were formed in the wheel by actual crushing against the diamonds.

For comparison, two steel rolls were tried, but the results obtained were better with the diamond tools. The finish on the work was slightly better, and the diamonds lasted 40 per cent longer. As to the actual cost, that of the diamonds and of the two steel rolls, hardened and ground, was about the same. Each diamond cost about $5, and each hardened and ground steel roll $5.

Care in the choice of diamonds is important, because while the diamond will stand more abrasion than steel, it is a great deal more brittle. This difficulty can be partly overcome by a careful examination of the diamonds. A quality should be selected without flaw lines. The use of diamonds with an angle of less than 90 degrees is not advised, as there is not sufficient body to provide the necessary strength.

It is also possible to form a 45-degree slant on a narrow wheel, as shown in Fig. 2, but some precautions must be observed. Sharp edges on a diamond, if exposed to the grinding wheel, would crumble. To prevent this, as many facets as possible should be polished on the upper part of the diamond. "Facetting" gives the diamond greater ability to resist stress and strain, at the point of contact, and helps to prevent crumbling. One of these polished flats is then placed in contact with the grinding wheel. As one facet wears, the diamond can be reset with another facet facing the wheel. Care should be taken to feed the diamond slowly toward the wheel until there is actual contact between wheel and diamond, when the actual crushing operation can proceed.

In attempting to form wheels in this manner, it is advisable to carry out an experiment with an ordinary sharp wheel-dresser. For example, a sharp thread-grinder dressing tool can be used and trial test runs made to see how many grooves can be dressed before the tool becomes dull.

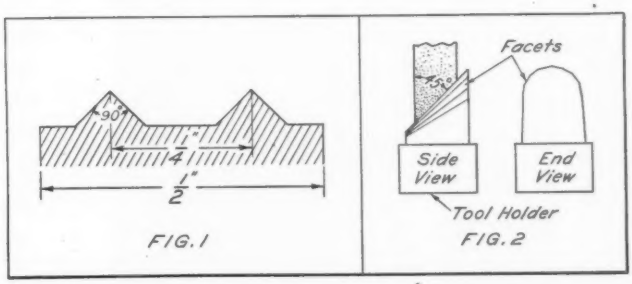


Fig. 1. Work to be Ground with Wheel Crush-formed by Two Diamonds. Fig. 2. Diagrammatic View Showing Diamond Used for Forming a 45-degree Slant on a Narrow Wheel

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Surplus Machines for Demonstration Rooms in Trade Schools

A commendable idea that deserves thorough consideration is that of using some of our surplus machine tools for exhibition purposes in vocational and trade schools and engineering colleges. These schools cannot have all types of machine tools in their shop, because some of the special types would not be suitable for operation in a school shop. It would be possible, however, to arrange a kind of demonstration room of machine tools in connection with these educational institutions, together with samples of work performed on the machines.

The machines should be wired, so that they might be run to demonstrate their motions, even though they were not actually operating on a work-piece. It is doubtful if some of the surplus machines could be put to a better use than this. The knowledge of machine tool design and operation among the students would be greatly increased in this way.

It has been suggested that Congress might well authorize the giving of surplus machines to non-profit educational institutions for exhibition purposes, if the machines are not required as a stand-by for our armed forces. The only requirement might be that the various institutions, in some appropriate manner, assure the distributing agencies that proper facilities are provided for such a demonstration room in the school, that it will be accessible to the students at regular hours, and that a qualified demonstrator will be available.

Engineering News

Spectrometer Analyzes Alloys in Forty Seconds

An electronic spectrometer which measures the concentration of elements in alloys and automatically records the results has been developed by J. L. Saunderson and co-workers at the Dow Chemical Co., Midland, Mich. The operation of the spectrometer is fully automatic, from the time the metal samples are placed in the instrument until the analysis is recorded on paper. Up to fourteen elements can be analyzed simultaneously.

It is said that the accuracy obtained with the new instrument is equal or superior to that obtained by standard spectrographic methods, and that analyses can be made in a fraction of the time required when using the latter methods—in some cases forty seconds. This electronic method of measuring the intensity of spectrum lines eliminates the necessity for photographic and developing equipment and a microphotometer.

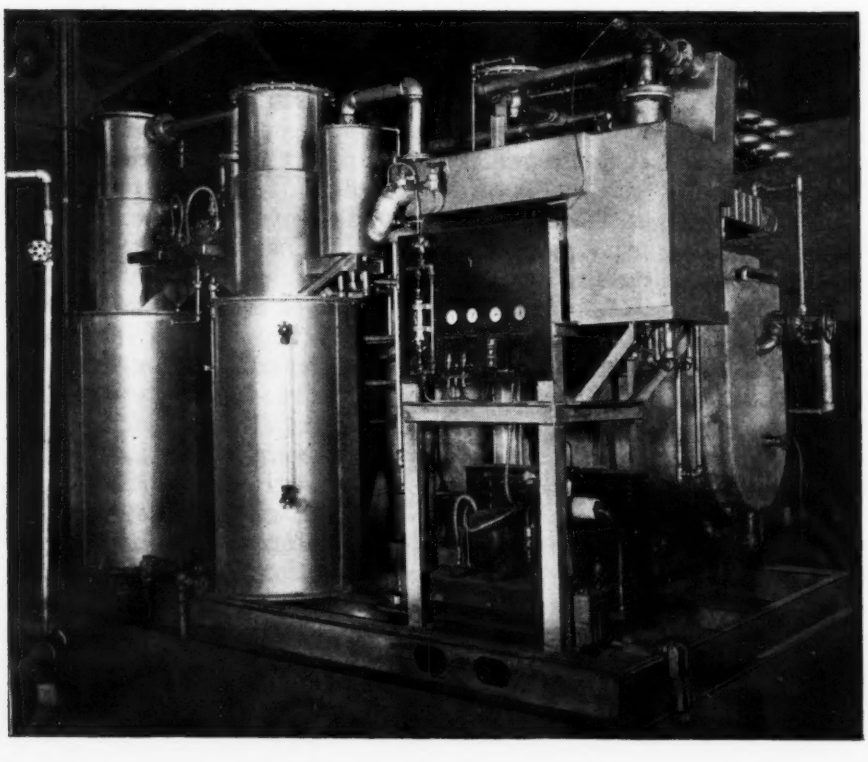
Betatron Makes X-Ray Pictures Through Fifteen Inches of Steel

X-ray pictures have been taken through 15 inches of solid steel by a 20,000,000-volt betatron machine made by the Allis-Chalmers Mfg. Co., Milwaukee, Wis. The machine has been in use for more than a year in a Government arsenal. The research that resulted in the development of this machine was performed by the University of Illinois and the Allis-Chalmers Mfg. Co., under a contract with the Office of Scientific Research and Development.

Dr. D. W. Kerst, physicist at the University of Illinois, was largely responsible for the developments that led to the successful machine. Allis-Chalmers then built the first betatron machine to withstand the rough usage encountered by operations in industry. This machine was put into service in the fall of 1944 at an Army ordnance plant. Since then other betatrons have been installed by the Government for taking X-ray photographs through thicknesses of steel unpenetrable a few years ago. The machines are operated by push-button, and have automatic controls for timing photographic exposures, so that no special skill is required to operate them.

Recent Developments in High-Speed Photography

An illuminating unit developed by Henry M. Lester, 101 Park Ave., New York City, of importance in scientific and industrial photographic research is said to produce 3,000,000 lumens—a brilliance four times as great as July sunlight; yet the heat created is not sufficient to affect the most sensitive subject. Coupled with a 16-millimeter



NX Gas (Inert Nitrogen) Atmosphere for Heat-treating Operations is Used Particularly with Molybdenum, Vanadium, and Other Alloy Steels. This Surface Combustion Gas Preparation Unit is Installed in a Large Steel Mill where It is Used in the Heat-treatment of High Alloy Steel

Eastman high-speed motion picture camera and a unique power control unit, this device permits the making of black and white and colored motion pictures, as well as still photographs, at exposures as brief as 1/15,000 second. This equipment is portable, easily prepared for operation, and can be used wherever ordinary electric current is available. It is said that this equipment can record actions as fast as 900,000 R.P.M., and one second of action can be magnified to three minutes of observation.

Cushioning Meter for Measuring Packing Efficiency

A cushioning meter offering a simple, rapid, and dependable means for determining the correct type, amount, and distribution of packing material to protect an article in shipment has been developed by the General Electric's Meter and Instrument Division at West Lynn, Mass. This meter measures the shock experienced by the object packed, thus checking the effectiveness of the packing.

The device consists of a detector head and an indicator. The detector head contains an electric mechanism which responds in varying degrees to the shock it experiences. This response is transmitted through a flexible cable to the indicator. In operation, the detector head is attached to a facsimile of the article to be packed, thereby eliminating the danger of damaging delicate or costly instruments or equipment while testing. After being attached to the unit, the sample package is dropped on a hard surface and the peak shock is read from the indicator, which is so arranged that it registers until a reset button is pressed, so that the operator need not watch the instrument pointer to catch an instant peak deflection.

The Microbalancer—A Supersensitive Balancing Machine

Ten years ago a dynamic balancing machine, designated the Dynetric, was brought out which had the ability to analyze vibrations, due to unbalance, that had an amplitude of only twenty-millionths of an inch. It was thought then that a finer degree of unbalance measurement would never be required. However, that ability to measure unbalance effects is too crude for many present-day high-speed rotating parts. This is particularly true of the wheels of gyroscopes, so important in bombsights, navigation instruments, and stabilizers. The rotors of superchargers also require extremely accurate balance. To balance such parts so that they will function without failure, it is necessary to reduce the amplitude of vibration due to unbalance to a fraction of a millionth inch.

To meet these requirements for extremely accurate balance, engineers of the Westinghouse Electric Corporation and the Gisholt Machine Co. cooperated to apply a superior type of amplifier to the fundamental principles of the Dynetric balancer. The resulting machine—the Microbalancer—can measure and locate unbalances that produce vibration amplitudes as small as a quarter of a millionth inch, which is one hundred times more sensitive than the standard Dynetric machine. The Microbalancer measures and locates the unbalance effect produced by a weight of one-millionth pound at a 2 1/2-inch radius on a ten-pound rotor. A piece of lint or a moist fingerprint weighs that much.

Many of the rotating parts that must be balanced to this degree of accuracy are normally supported on ultra-precision ball or roller bearings. Before these parts are balanced, the almost infinitesimal defects in the bearings produce vibration effects in addition to the vibration produced by the unbalance. These random vibrations caused by the minute defects in the bearings frequently are one hundred times as great as the minimum permitted vibration of the balanced rotor. By the use of extremely effective filters, superimposed on the filtering characteristics of a wattmeter, the desired separation of vibration effect was obtained.

Heat-Resistant Synthetic Rubber for Forming Magnesium

Since the beginning of the war, rubber forming pads for the cold-forming of aluminum have been extensively used. These pads are not suitable for shaping magnesium, however, because magnesium tends to be brittle when cold and cannot be satisfactorily formed without heating. The rubber forming pads used in the past could not withstand heat.

A new heat-resistant synthetic rubber has now been developed by the United States Rubber Co., Rockefeller Center, New York City, which withstands temperatures up to 450 degrees F.—the temperature required in this case. This synthetic rubber is made in pads weighing as much as 2800 pounds and measuring 116 inches long, 50 inches wide, and 8 inches thick. The rubber pad is used as the female die in hydraulic presses to form heated magnesium under 5000 tons pressure. When the pressure is released, the rubber returns to its original form.

Device that Locates Position and Depth of Buried Pipe and Cable

Determination of the location and the testing of buried pipe and cable can be accomplished with the Stewart cable tester and locator made by W. C. Dillon & Co., Inc., 5410 W. Harrison St., Chicago 44, Ill. The unit is said to locate shorts, crosses, grounds, and wet spots, and tell where the cable or pipe is buried and just how deep. It is also valuable for checking depth of cable at river crossings. The portable unit used for this purpose weighs only 22 pounds.

Editorial Comment

The taxing power of the Government can be used to promote as well as retard industrial activity. The general effect of the Undistributed Profits Tax, now repealed, was to discourage the buying of industrial equipment and to retard industrial activity in the machine-building industries. On the other hand, a fiscal measure that has been applied abroad, which, in effect, exempts from corporation income tax that part of the year's income which has been used for buying industrial equipment, has the effect of encouraging rehabilitation in machine-using plants and of greatly stimulating activity and employment in the machine-building industries.

Tax Policy that would Stimulate the Use of Better Equipment

Examples have been cited from time to time in the technical press of companies that actually replace 10 per cent of their equipment every year—that is, if they depreciate their equipment by 10 per cent annually, they actually invest in new equipment an amount equal to that charged to depreciation. Since all the concerns following this practice have been conspicuously successful, it would appear to be a very desirable thing for the machine-using industries, and for the country as a whole, if, through taxation policies, manufacturers were encouraged to expend a part or all of their annual depreciation reserve for buying new equipment.

What taxation policy would have this effect? How would it be possible to direct, through the pressure of taxation, part or all of the amounts ordinarily charged to depreciation into the channels of new equipment buying? An example will illustrate how this could be done. Suppose that a concern normally charged $100,000 to depreciation of its machinery each year. Assume, further, that this concern bought $50,000 worth of new equipment during the year. Suppose that this concern were permitted to deduct not only the $100,000 depreciation, but also the $50,000 used for buying new equipment, from the amount subject to corporation income tax. Would not this act as a stimulus toward the buying of new equipment? In order to prevent the additional amount exempt from corporation income tax because of equipment purchases from becoming too great, it might be limited to a figure equal to the depreciation charge.

It has been Done Elsewhere and has Produced Results

Other plans may be proposed to achieve the same object. The main point, however, is that taxation can be used to encourage industrial activity, just as it has been used in the past to hamper industrial progress. The total tax receipts of the Government are not likely to be reduced by this procedure; in fact, they would probably be greater because of increased business activity, larger corporation income, and increased employment.

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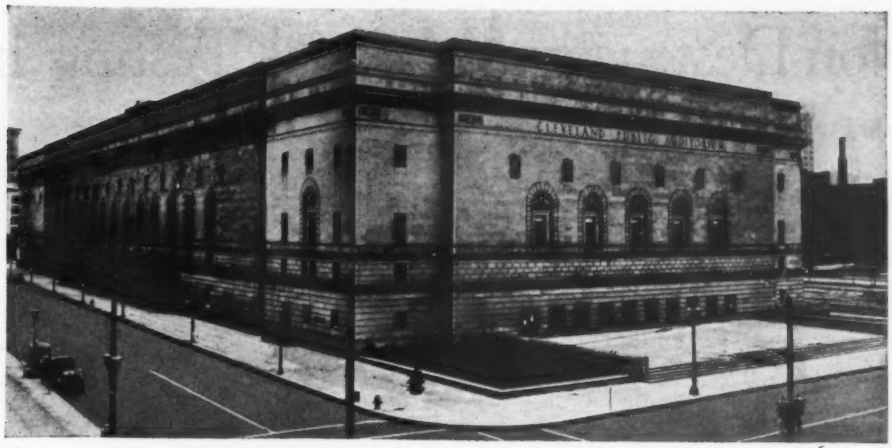
Various Governmental agencies have emphasized the necessity for the success of the small business enterprise if full employment is to be obtained. As a matter of fact, the success of large enterprises is equally important—even more so, in fact—to the attainment of full employment.

However, the success of the small enterprise is of extreme importance to the health and stability of our national economy. All businesses cannot be large, and tens of thousands of small businesses throughout the nation play a vital part in our national life.

Those men within our Government who formulate policies, and who emphasize the importance of the small business enterprise, should ask themselves, How does the small enterprise prosper? Assuming that it is capably managed, it will prosper exactly to the degree that it is left alone by the Government. In a small enterprise, the owner or manager has to perform, himself, a great many duties that in a larger enterprise are handled by others. It is, therefore, important that his time should not be occupied by filling out Government questionnaires, reports, etc.; nor should he have to waste his time unnecessarily attending hearings of labor boards, tax boards, renegotiation officials, and many of the Government emergency agencies that have survived the war.

Business Must Resist a Dictatorship of Bureaucracy

The Government has forced upon business an enormous amount of clerical work that is not necessary to the successful conduct of a business, but is required simply because of Government interference. We need simplification in Government; small business, as well as large, suffers by having to carry the burden of the extra work required because of the Dictatorship of Bureaucracy which is largely the type of Government under which we now operate.



National Metal Congress and Exposition

CLEVELAND, FEBRUARY 4-8

THE National Metal Congress and Exhibition, deferred because of war conditions, is now scheduled to be held in the Public Auditorium and Underground Exhibition Hall in Cleveland, Ohio, beginning Monday, February 4, and continuing for five days through Friday, February 8. More than 350 manufacturers of metals, equipment, and processes will have exhibits in the Metal Show, which will cover ferrous and non-ferrous metals, and equipment for processing, welding, fabricating, testing, and inspection. Many developments for wartime production, now available for general industrial use, will be exhibited for the first time. The exposition will open at noon and close at 10:30 P.M., Monday, Tuesday, and Wednesday, February 4, 5, and 6. On Thursday and Friday, February 7 and 8, the exposition will open at 10 A.M. and close at 6 P.M.

This is the twenty-seventh National Metal Congress and Exposition sponsored by the American Society for Metals, with headquarters at 7301 Euclid Ave., Cleveland 3, Ohio. According to W. H. Eisenman, managing director of the exposition and national secretary of the American Society for Metals, every indication points to an attendance in excess of 30,000 industrial visitors. The show will occupy a floor space 25 per cent larger than that covered by the exposition held in Cleveland under the same auspices in 1944. All together, the show will occupy more than eight acres of display area, and the exhibitors will have more than 1500 executives, engineers, and sales managers in attendance.

In conjunction with the exposition, technical meetings will be held by the American Society for Metals, and it is expected that group meetings of other technical societies will also be held. Thirty-one technical papers, four daily educational courses, and three round-table evening sessions will be included in the program of the American Society for Metals. Among the subjects that will be dealt with in the educational courses are problems pertaining to the processing of magnesium, the use of induction heating in industrial work, corrosion of metals, and the effect of surface stressing of metals on endurance in repeated loadings.

At the regular technical sessions, of which there will be ten, some of the subjects to be dealt with are as follows: Deep-Drawing of Aluminum Alloys at Elevated Temperatures; Aluminum Alloys Containing Small Amounts of Beryllium; Iron Manganese Alloys; Surface Decarburization of Steel; the Effects of Combined Stresses and Low Temperatures on the Mechanical Properties of Non-ferrous Metals; Soft Soldering; Influence of Carbon Content on Chromium Steels; Effect of Nickel on Cast Chromium-Molybdenum Steels; Hardenability of Boron-Treated Steels; Quenching of Steel Balls and Rings; and Metallurgical Characteristics of Induction-Hardened Steel.

Presentation of four medals will be a feature of the annual dinner of the Society Thursday evening, February 7, at the Hotel Statler. The Henry Marion Howe Medal for the paper of the highest merit published in the Transactions of the Society during the year 1944; the Albert Sauveur Achievement Award; the American Society for Metals Medal for the Advancement of Research; and the American Society for Metals Gold Medal will be awarded.

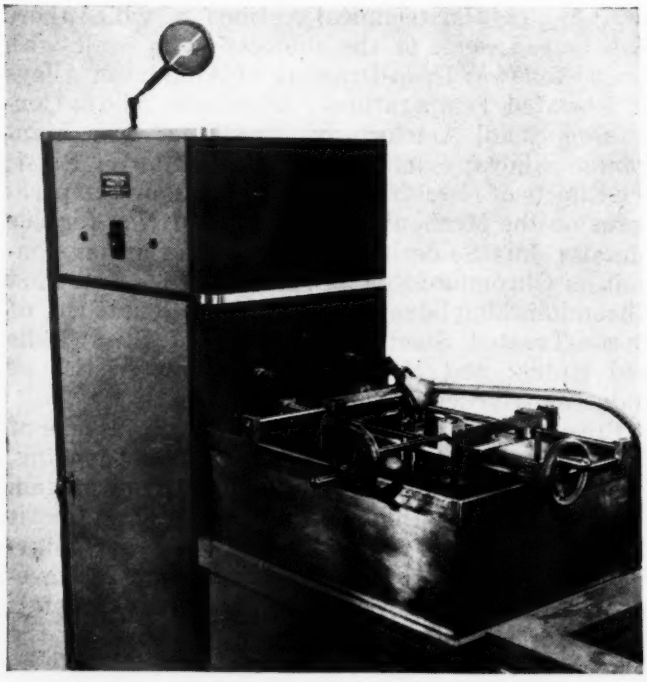
Non-Destructive Material Testing by the Hypersonic Analyzer

PRODUCTION testing of any material for defects must be non-destructive, and the test must be rapid and convenient. Hypersonic testing, introduced by the Brush Development Co., 3405 Perkins Ave., Cleveland, Ohio, has been added to the list of methods for examining flaws in materials that meet these requirements.

Basically this method consists of a sound generator which sends a beam through the specimen to be tested. The specimen, depending on its properties, modifies the beam, and the resulting energy pattern is picked up on the side opposite the generator by means of a microphone. It is possible to so select radiation frequencies and electro-acoustic designs that the resultant beams through the material are highly modified by a given type of flaw in any given material.

This method of testing is particularly applicable to materials having a constant cross-section, such as those produced by rolling and extrusion. The material can be examined continuously as it traverses between a pair of transducers. Flaws will change the energy level in the microphone, which, in turn, operates a relay that either marks or rejects the material or part of the material containing the flaw. Since the frequency of operation normally lies between 50 and 1000 kilocycles per second, the relay action is very fast and the material can flow through the device at high speed.

The Hypersonic analyzer consists essentially of three parts: (1) A Piezoelectric crystal transmitter; (2) a Piezoelectric crystal receiver; and (3) a signaling or marking device.



A Brush Hypersonic Analyzer Test Unit

The crystal transmitter sends supersonic waves through the material being examined. These waves are picked up by the crystal receiver, and a constant result is registered until flaws, or a definite change in density, are encountered. The detection and identification of the defect may be indicated in any of several ways—on a meter; by a signal light or a bell; or by using a relay hook-up for producing whatever physical markings may be desired such as a paint spray, an inspector's rejection stamp, or a continuous ink-on-paper chart record. The relay hook-up could also be used for operating an ejector mechanism.

Generally speaking, the use of a liquid as the transmitting medium is desirable in Hypersonic inspection. The reason for this is that fluids, such as water and oil, provide a better coupling between the transmitter, the material under inspection, and the receiver at supersonic frequencies. However, in certain instances, air or some other gas makes a satisfactory transmitting medium. The choice of medium depends upon the particular material being examined, and also on the physical possibility of exposing the material to the medium.

Among the applications of the Hypersonic analyzer should be mentioned its use in the rolling of sheet steel. It will accurately detect and identify the location of "pipes," "cats' eyes," "blisters," and laminations. Moreover, since it detects such flaws early in the manufacturing process, appreciable savings in the time and money expended on further finishing can be made. Experiments indicate that flaws as small as 0.001 inch in thickness can be detected by the analyzer. Such flaws, it is stated, cannot be detected by any other known inspection method. Satisfactory tests have also been made on aluminum, phosphor bronze, beryllium copper, brass, and other metals and alloys, as well as on plastics.

It is also expected that the Hypersonic analyzer will be used for a wide variety of applications in industries where the bonding of materials is required in a manufacturing process. Since any separation, no matter how small, between two bonded surfaces can be indicated, inspection of such materials is now entirely practicable, even though it may have been impossible in the past.

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It is just as much up to Management to regain control of costs as it is up to Labor to deliver a full day's work for a full day's pay. There is no more excuse for inefficiency in the front office than in the shop.—*George T. Trundle, Jr.*

Die for Forming Irregular-Shaped Spring

By L. KASPER, Philadelphia, Pa.

The die shown in the accompanying illustrations was constructed for forming an irregular-shaped spring. This spring, of the shape shown in Fig. 4, is made of fully annealed spring steel, and is hardened and tempered after forming. Originally the spring had been formed in three operations, but as the required accuracy and uniformity could not be obtained in that manner, it was decided to attempt to complete the forming in one operation.

Referring to Fig. 1, the punch *L* has entered the die at the first half of the ram stroke. Block *A*, which is supported on the bolster plate of the press, carries the two plungers *J*, which are held outward by two springs, one of which is shown at *K*. Plunger *E* passes freely through block *A*, and is held in its upper position by the pneumatic cylinder *F*, Fig. 2, which passes through the bolster plate, stopping on the under side of block *A*.

Two blocks *B*, attached to block *A*, are grooved on their inner faces to carry the forming die *D*, which is free to slide vertically. The upper faces of blocks *B* are grooved to carry the slide blocks *C*, retained by plates *G*. Two strips *I* keep blocks *B* from spreading and support the two levers *H*. Levers *H* are acted upon at their lower ends by the spring plungers *J*. The pressure of springs *K* is multiplied through the levers *H*, acting on slides *C* in the reverse direction. Punch *L* is formed to the contour of the inside of the spring to be produced, some allowance being made for springback of the material.

Referring to Fig. 3, which is a partial plan view of the die, and Fig. 5, which is an end view, it will be noted that plates *G* do not cover slides *C*, but are spaced to act as locating guides for the work *W*, which is shown in position in Fig. 3. Two pins *M* in slides *C* serve to locate piece *W* centrally over the opening in forming die *D*.

After the work *W* has been placed between plates *G* and pins *M*, as shown in Fig. 1, punch *L* descends, forcing the work into die *D*, which is held in its upper position by the pressure of the pneumatic cylinder through pin *E*, thus forming the first bend. Continued downward movement of punch *L* forces die *D* down against the resistance of the pneumatic cylinder. As soon as die *D* starts its downward movement, slides *C* are forced inward by plungers *J* acting on levers *H*, which causes piece *W* to be held tightly against punch *L*.

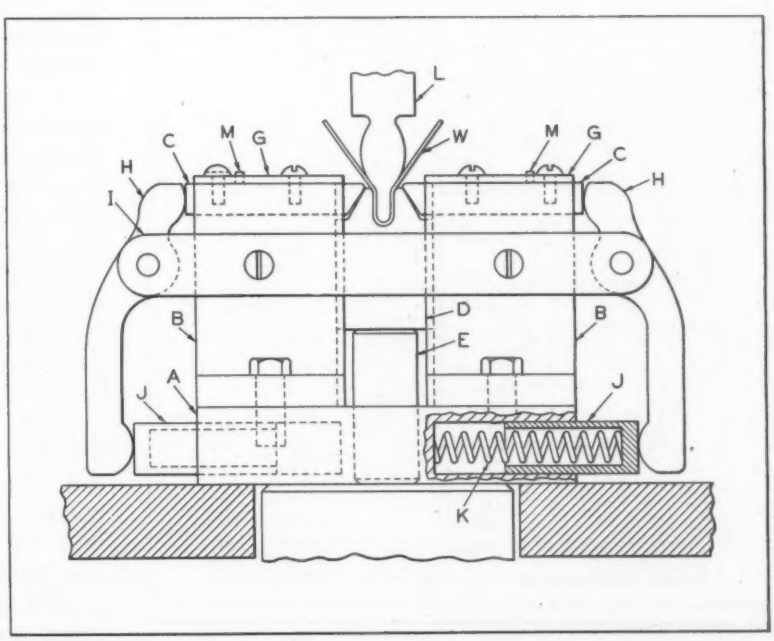


Fig. 1. Die Designed to Form with One Stroke the Irregular-shaped Spring Shown in Fig. 4

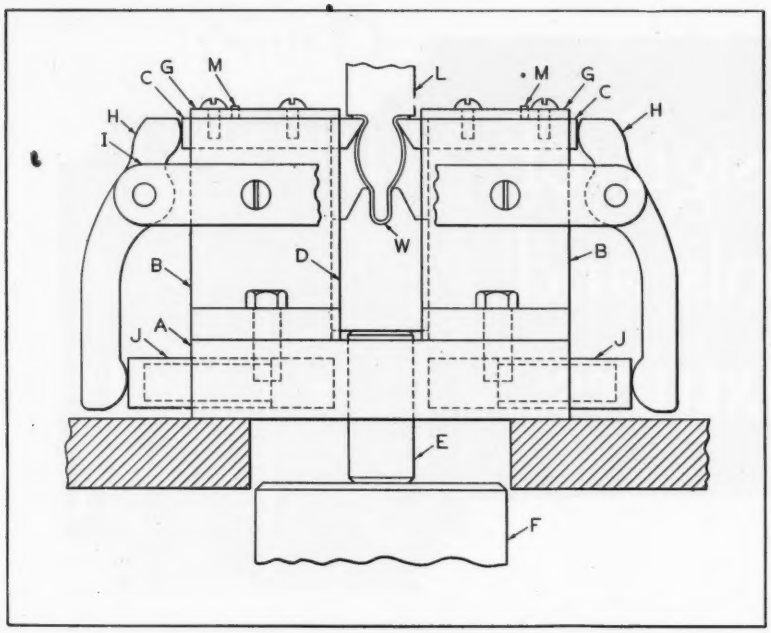


Fig. 2. Die Illustrated in Fig. 1 with Punch L Shown at the End of its Downward Stroke

Continued downward movement causes piece *W* to be formed to the contour of punch *L* by the ends of slides *C*, the spring action forcing slides *C* to accurately follow the contour of punch *L*.

Fig. 2 shows the die with the punch at its lowest position; the completely formed piece *W* is shown in position, the short upper ends having been turned over and set by the shoulders of punch *L* which forced them down on the ends of slides *C*.

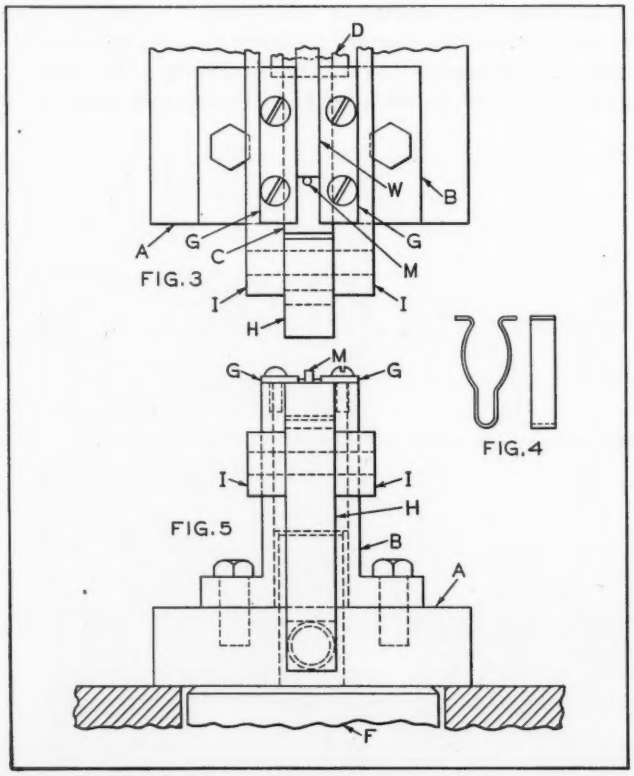


Fig. 3. Partial Plan View of Die Illustrated in Fig. 1. Fig. 4. Spring Formed by Die. Fig. 5. End View of Die

Riveting Fixture for Grooved Stud

The accompanying illustration shows an effective and simple design of riveting block for assembling a small mild-steel lever to a fulcrum stud, the latter having a deep annular groove formed at its lower end. Previous methods of holding the stud and lever together while peening over the end of the stud resulted in distortion of the grooved portion of the stud. Thus subsequent fitting of the stud to its mating parts was difficult and many parts were scrapped. The fixture illustrated not only proved successful in overcoming these difficulties, but served to increase production as well.

Referring to the illustration, an assembly of a grooved stud and lever is shown in position in the fixture, which consists of a rectangular cast-iron block *A*, to the bottom of which the plate *B* is secured by means of screws. Block *A* has a centrally located hole passing vertically through it. This hole receives the cylindrical shank of the casting *D*, the upper end of which is in the form of a circular flange.

In the shank of member *D* is machined a short keyway *E* into which fits the pilot end of the screw *F*, which is screwed into a tapped hole in block *A*. This hole is counterbored for a certain depth, so that when the head of the screw bears tightly at the bottom of the counterbore, the pilot end projects sufficiently into keyway *E* without restricting the vertical movement of member *D*. Screw *F* prevents member *D* from being withdrawn from block *A*.

The shank of member *D* is provided with a blind hole which is a clearance fit over the outside of the stiff compression spring *G*, acting between the baseplate *B* and the end of the blind hole, thereby keeping *D* in a raised position until it is depressed by action of the press ram.

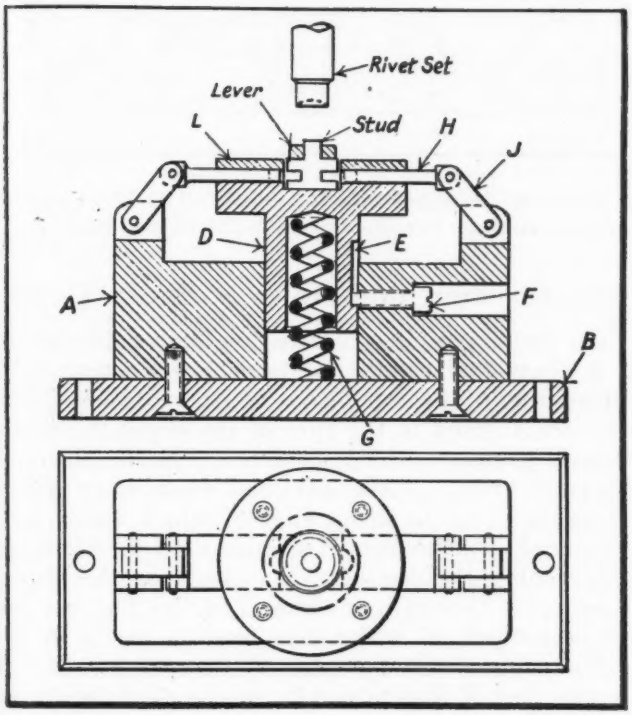
In the flange of member *D* is a shallow recess, located centrally and having a depth equal to the thickness of the bottom flange of the grooved stud plus the width of its groove, and a diameter which permits the stud to be easily placed in the position shown.

Across the top of the flange of *D* a parallel-sided slot is machined which is a sliding fit for the plates *H*. This slot is about 1/8 inch wider than the outside diameter of the stud, and the plates are about 0.003 inch narrower than the annular groove around the stud, into which they pass readily. Machined centrally in the end of each plate *H* is a semicircular slot of about the same diameter as the bottom of the groove in the stud, so that the plates will almost fully enclose or fill up the groove in the stud.

The outer end of each plate member *H* is thickened, slotted, and drilled to take a pin-connected link *J*, which is pivoted freely to the plate. The lower end of each link is pivoted freely in a slot

provided in a vertical projection on the top of block *A*. The plates *H* are retained vertically in their guide slots by the ring *L* secured to the flange of *D* by four screws (not shown).

In operation, the stud to be riveted is dropped into the recess in the top of member *D* and the lever is placed in position on the stud end. A rivet set carried in the ram of a hand press is then lowered until it comes in contact with the end of the stud. Further downward movement depresses the flanged member *D* against the pressure of spring *G*. This continued downward travel also causes



Fixture Designed for Riveting Lever to Grooved Stud

the two opposed plates *H* to move inward and fill the annular groove in the stud by reason of the fixed centers at the lower ends of the links. Thus when member *D* has reached its lowest position, or when the under side of the flange bears against the top face of block *A*, the groove in the stud will be occupied by the ends of the plates *H*. A further slight downward movement of the press ram will cause the rivet set to peen over the end of the rivet.

Upon reversing the stroke of the press ram, spring *G* will cause member *D* to move upward until the lower end of the keyway bears against screw *F*, the plates *H* then being forced outward from the groove in the stud.

Milling T-Slots with Carbide-Tipped Cutters

The machining of T-slots in a British plant is being performed with carbide-tipped cutters of the interesting and rather unusual design shown in the accompanying illustrations. One of the mild-steel pieces in which a T-slot has been cut is shown at *A* in Fig. 1. The slot is cut in two operations, the first cut being taken with the four-toothed milling cutter *B*. This cutter mills a vertical slot 9/16 inch wide and 25/64 inch deep. The second cut, which completes the T-slot, is taken with the cutter shown at *C*, which is 31/32 inch in diameter and 25/64 inch wide.

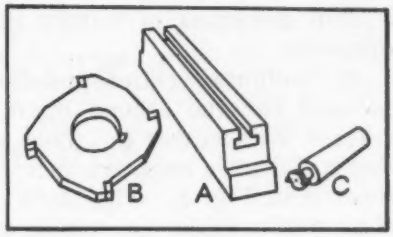


Fig. 1. Cutters B and C Used to Mill T-slot in Bar A

Details of the two cutters are shown in Figs. 2 and 3. The first cutter is 6 inches in diameter and has each of its four teeth tipped with cemented carbide. It will be noted that the edges of the teeth which machine the sides of the slot have a negative rake of 3 degrees. This negative rake is obtained by having a 3-degree rake angle extended from the center of the front face to each side, thus giving the front face a very broad wedge or V-shape, as shown in the view to the right in Fig. 2.

The first operation is performed on a Cincinnati No. 4 plain medium-speed dial type milling machine with the cutter *B*, Fig. 1, running at a speed of 465 R.P.M. This gives an approximate surface cutting speed of 730 feet per minute. A feed of 15 3/8 inches per minute is employed, which gives

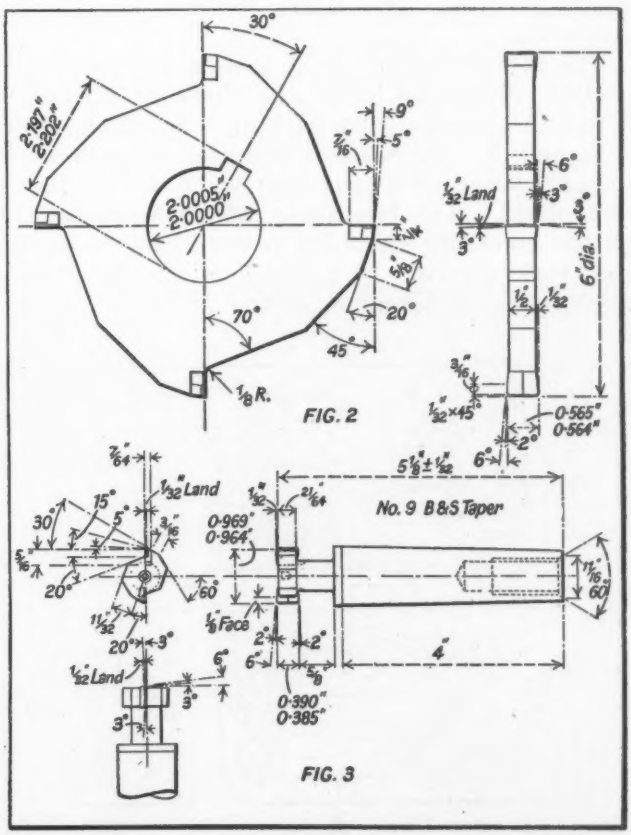


Fig. 2. Details of Cutter Used for First Operation in Milling T-slot. Fig. 3. Cutter Employed for Second Operation, Required to Complete T-slot

a chip thickness of 0.0083 inch for this milling operation.

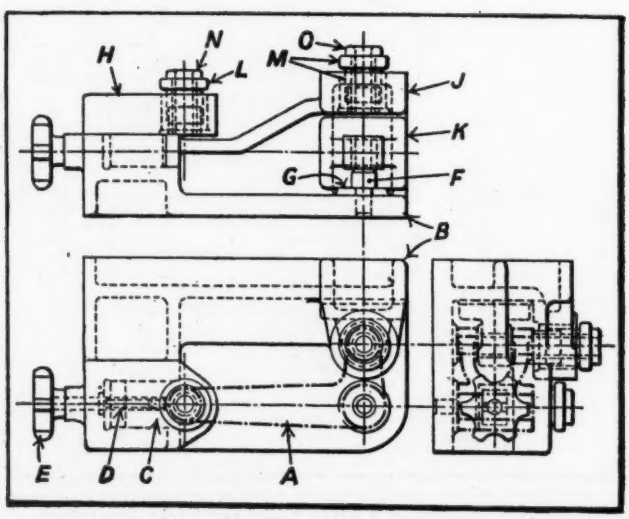
A Cincinnati vertical-spindle Hydro-Tel machine is used for the second operation, which is performed with cutter *C*. This cutter has two teeth and a 3-degree negative face or rake angle, as indicated in Fig. 3. The teeth are also tipped with cemented carbide. A spindle speed of 1800 R.P.M. is used for this cutter, which gives a surface cutting speed of 456 feet per minute. The table feed is 7 1/2 inches per minute, which gives a chip thickness of 0.002 inch.

Jig Designed for Drilling a Bellcrank Lever Having a Forked Arm

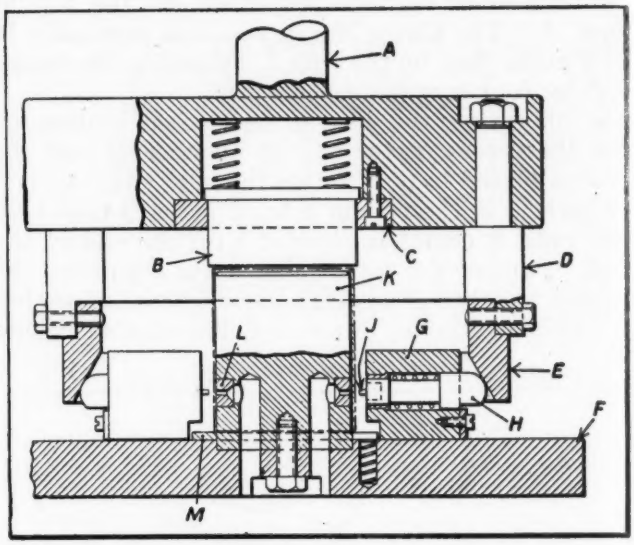
The accompanying illustration shows a drill jig for a bellcrank lever, the short arm of which is forked. The lever is shown by dot-dash lines at *A*. The boss faces are milled and the fulcrum boss is drilled and reamed in previous operations. The jig body *B* is machined to receive a sliding V-block *C*, which is controlled by the screw *D* and the handwheel *E*.

The work is placed over the locating pin *F* and lowered on the face *G*. The two levers of the component are then swung into position under the drill-bushing brackets *H* and *J*. Bracket *H* is fastened to the body of the jig and serves also as a top guide for the sliding V-block. A block *K*, which is designed to fit between the forked end of the work, supports the latter during the drilling operation.

The threaded bushings *L* and *M* have a parallel portion above and below the threaded portion to maintain accuracy. Slip bushings are also provided at *N* and *O*. The work is definitely located at the fulcrum boss and at the long lever end by the V-centralizer. The two threaded bushings provide all the necessary clamping power required to hold the work securely in position while the drilling operations are being performed.



Jig Designed for Drilling a Bellcrank Lever Having a Forked Arm



Die with Radially Positioned Punches J for Punching Holes in Short Lengths of Tubing Placed over Block K

Die for Punching Holes in Short Tubes

The accompanying illustration shows the design of a press tool or die for punching a number of holes around the periphery of short tubes. The member *A*, fixed in the ram of the press, carries a slidable pressure pad *B*, which is held in place by means of ring *C*. Also attached to member *A* are the posts *D*, to the lower ends of which the ring *E* is secured. On the base *F* are mounted the blocks *G* which carry the plungers *H* containing the punch inserts *J*. Centrally mounted in the base is the locating block *K* which has the die-blocks *L* inserted around the periphery. A spring-actuated ejector ring *M* is retained by blocks *G* at the lower end of block *K*.

In operation, the tube to be punched is placed over the locating block *K*. When the ram descends, the spring actuated pressure pad carries the tube down against the pressure of the ring *M* until checked by the base. Further downward movement of the ram causes the ring *E* to move the plungers *H* horizontally, thereby punching the required holes in the work. On the reverse stroke of the ram, the ring *M*, through spring action, moves upward and helps to eject the punched part.

The slugs from the punching operation drop down through holes in the central block *K*. The positions of blocks *G* can be adjusted around the tube both in height and radially to accommodate various hole positions. The punches and die bushings are so arranged that they can be easily removed for replacement or sharpening.

* * *

Competent radio service and repair men were scarce before the war and more so during the war. This should no longer be the case when the men in the Army and Navy are discharged, because the armed services have trained more than 500,000 radio technicians, operators and repair men.

Electronic Control Widens Scope of Oxy-Acetylene Cutting Machines

A NEW electric-eye tracing device for pantograph type oxy-acetylene cutting machines that radically simplifies steel cutting operations and for the first time makes intricate design cutting practical—considerably expanding the present application of torch-cutting machines in industry—has been announced by Air Reduction, 60 E. 42nd St., New York 17, N. Y. The new device, applied to machine gas cutting in collaboration with the General Electric Co., will be known as the "Electronic Bloodhound." It completely eliminates expensive metal and wood templets and all other mechanical or manual auxiliary guiding devices.

Electronically controlled tracing equipment cuts the most complicated shapes with great precision from quickly prepared outline drawings or silhouettes of the desired shape. There are no limitations to the variety of designs which can be cut, as the electronic tracing head faithfully follows the most complex angles and curves on the drawing with extreme accuracy.

A new field of application has been opened in machine production cutting through the "chain" method of reproduction made possible with this type of templet. In the chain method, a series of identical shapes are drawn on the templet and connected with a continuous line which is automatically followed by the tracing eye. This makes possible the production cutting of several pieces in a single operation.

In plants where a great variety of special shape-cut pieces are made, the economy of this low-cost templet preparation is particularly important. Alterations in the drawing followed by the tracer can be quickly made—a fact of particular importance when small dimensional changes are made in a part. Shape-cutting is no longer limited to the ability of the tracing device to follow the templet contour, and sharp corners can be cut without subsequent machining or the use of elaborate jigs.

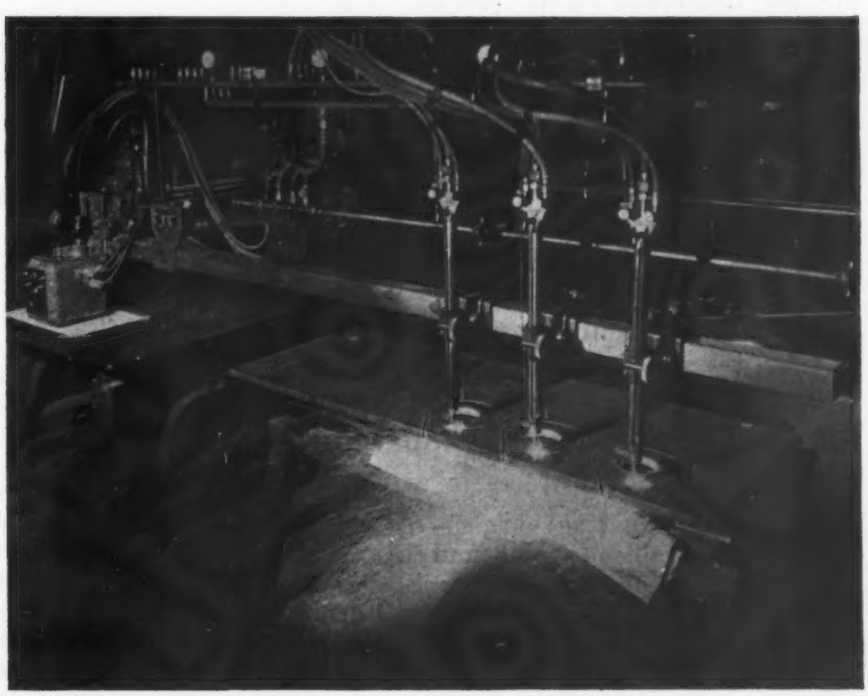
The templets required for electronically controlled cutting are simple outline drawings or silhouettes—a black outline about 1/8 inch wide against a white background, or any other color combination which provides sufficient light contrast. These drawings may be treated with a protective coating to lengthen their life.

The electronic tracing equipment consists of two units—the tracing head and the control box. This equipment is easily attached to any Oxygraph or Travograph cutting machine in place of conventional equipment.

* * *

Instrument Society of America

The Instrument Society of America held an organization meeting and dinner recently at the Hotel Roosevelt in Pittsburgh. Delegates and members from fourteen sections of the Society attended. The chairman of the membership committee reported that the Society now has over 1400 members in all of its eighteen sections. Plans have been made to hold an exhibit and convention in Pittsburgh on September 16 to 20.



Electronic Tracing Equipment Installed on an Oxygraph Cutting Machine, Three Identical Parts being Cut at Once from an Outline Drawing Followed by an Electric Eye

Materials of Industry

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

New "Elastuf" Chrome-Vanadium Steel with High Strength and Toughness

A special chrome-vanadium steel containing small controlled amounts of nickel and molybdenum, which is known as "Elastuf Type A-2," is now being produced by Horace T. Potts Co., Erie Ave. at D St., Philadelphia 34, Pa. This is a commercially machineable steel supplied in a heat-treated, stress-relieved condition. It has a tensile strength ranging from 125,000 to 160,000 pounds per square inch, a yield point of 100,000 to 145,000 pounds per square inch, an elongation in 2 inches of 15 to 22 per cent, and a Brinell hardness of 262 to 341. Both hardness and tensile properties are uniform within close limits throughout any cross-section. This steel is suitable for use where high strength and resistance to impact, fatigue, wear, shear, and compression are called for. It is also adapted for use where high temperatures are encountered. 201

Improved Drawing Compound for Stamping Operations

A drawing compound that maintains its inherent physical properties during repeated stamping operations on ferrous and non-ferrous alloys has been developed by the Northwest Chemical Co., 9310 Roselawn Ave., Detroit 4, Mich. This compound, known as "Superdraw," has a high film strength. It is unaffected by atmosphere and heat, and leaves no heavy scale nor stain on the surface of any alloy. Application is by hand, brush, spray, roller, dipping, or pouring. The compound may be diluted with warm water to suit the draw. It is easily removed by an alkaline cleaner and the use of any routine cleaning procedure. 202

Silicone Varnish for Impregnating Electrical Equipment

A new impregnating varnish—DC 996—which is an inorganic silicone compound that cures at the low temperature of 300 degrees F., has been introduced on the market by the Dow Corning Corporation, Midland, Mich. This varnish, developed for impregnating the windings of electrical equipment, provides greater protection against failure due to sustained overloads; greatly increased service life of electrical insulation; higher permissible operating and ambient temperatures; increased protection against excessive moisture, even after prolonged exposure to elevated temperatures; the elimination of fire hazards; and increased power output per unit weight.

Another advantage of this new silicone varnish is that electrical equipment can be baked fully assembled without damaging the commutators or the slip rings. The temperature required to cure the DC996 varnish does not affect shellac-bonded mica or core plating. 203

Lubricant Developed for High-Speed Chain Conveyors

A lubricant for high-speed chain conveyors has recently been developed by Turco Products, Inc., 6135 S. Central Ave., Los Angeles 1, Calif. Heretofore, the common practice has been to use soaps, but in many cases it has been found that this material caused corrosion and frequent shut-downs. The new product, marketed under the name "Botlube," is non-staining, soapless, non-corrosive, and contains no oil. It has a high degree of wetting action; one drop will quickly cover a very large area with a thin but exceptionally durable film. 204

Corrosion Protection for Cadmium and Zinc with One Dip

A new process developed by United Chromium, Inc., 51 E. 42nd St., New York 17, N. Y., known as "Unichrome Dip," provides a convenient and economical means of obtaining corrosion protection coatings on cadmium and zinc. By converting the surface to chemically inert compounds, either black or olive drab finishes can be produced, which prevent the formation of white corrosion products and also provide an excellent base for paint or lacquer.

An outstanding advantage of this process is that parts require only a single immersion of from two to five minutes. Other advantages are that no special equipment, racking, or current is required;

To obtain additional information on materials described on this page, see lower part of page 211-A.

parts are handled in bulk and treated at room temperature; and maintenance and control of the solution is both easy and inexpensive. In addition to being a quick, economical process, coatings produced in "Unichrome Dip" offer a high degree of protection, preventing the appearance of white corrosion products under the standard salt spray test for periods up to two hundred hours.....205

Nickel-Steel Tubing for Low-Temperature Applications

Tubing made of 9 per cent nickel steel, which is designed especially for sub-zero temperatures, is being manufactured by the Babcock & Wilcox Tube Co., Beaver Falls, Pa. This tubing was developed primarily to meet the pressure tubing needs of plants handling liquefied gases or other low-temperature fluids, and exhibits good physical properties even at temperatures as low as minus 320 degrees F. (minus 196 degrees C.) According to H. D. Newell, chief metallurgist and director of the company's laboratory, the new product may be applied in low-temperature work as a substitute for 18-8 stainless steel tubing. 206

"Dipwrap" Compound Provides Durable Protection for Metal Products

A hot dip compound known as "Dipwrap," which provides a high degree of protection for metal products during shipment and storage, is now being supplied for civilian use by Paisley Products, Inc., 1770 Canalport Ave., Chicago 16, Ill. The product to be protected is dipped in a hot solution of the compound, and after a five- or ten-second cooling period is ready for shipment or storage. The resulting tough, resilient coating provides a shock-resistant cushion for the protection of machined surfaces and cutting edges. The coating is impervious to air and moisture, and thus prevents rust and corrosion. It is easily removed by peeling. 207

New Type of Thermit for Producing Steel Castings

A new type of Thermit known as "Thermicast," which is used to produce steel castings, but is not suitable for any type of welding work, is now being produced by the Metal and Thermit Corporation, 120 Broadway, New York 5, N. Y. The equipment for producing the steel, which is also supplied by this company, consists of a metal crucible with refractory lining, a receiving ladle, and a slag collecting basin. The Thermicast mixture is supplied in bags of 41 pounds gross weight, each of which produces approximately 25 pounds of steel. Two sizes of crucibles are available, and using extension rings for increasing their capacity, up to 500 pounds of steel can be produced at a single heat.

The basic Thermicast mixture produces a mild steel of about 0.25 per cent carbon, 0.68 per cent manganese, and 0.11 per cent silicon content. Regular foundry practice is followed in the preparation of patterns and molds with this method of producing steel castings. 208

Internal Plating Process Makes Steel Pipe Corrosion-Resistant

The inside of steel pipe can be electroplated with nickel or other metals by means of a process known as the "Bart Lectro-Clad" process, developed by the Bart Mfg. Co., 277 Main St., Belleville, N. J. The new process develops a smooth, ductile, pore-free nickel deposit, fully adherent to the base metal, and it can be applied to pipe or tubing up to 18 inches in diameter with lengths up to approximately 20 feet. The use of the Bart Lectro-Clad process gives steel pipe the corrosion resistance of nickel while retaining the low cost, strength, and fabricating characteristics of steel. Fittings and pipe-line accessories are also available for complete piping systems.

The internally plated pipe can be welded, reduced, and bent (hot or cold) without destroying any portion of the internal lining. In reducing pipe or tubing that has been plated internally by the cold reduction method, it is possible to predetermine the actual thickness of the plating throughout the entire reduction, since the applied metal and the base metal reduce in equal ratio..209

Improved Flux for the Gas-Welding of Aluminum

An improved, free-flowing flux for the gas-welding of aluminum and aluminum alloys, known as "Flo-Well No. 1," is being manufactured by A. K. Mauk, 7587 Hamilton Ave., Pittsburgh 8, Pa. This flux can be used in the gas-welding of wrought, cast, or high-tensile aluminum and aluminum alloys of any size or shape. As a result of improved methods of manufacture, it will not solidify or deteriorate. 210

Liquid Prevents Fog or Steam on Glass or Plastic Surfaces

A new product called Merix "Anti-Fog," developed by Merix Photo Co., 712 Wrigley Bldg., Chicago, Ill., prevents fog, mist, or steam from forming on glass or plastic surfaces. It is easily applied with a soft cloth, and forms an invisible, protective film which keeps the surface free from moisture for an indefinite period. It is suitable for treating goggles, gas masks, and safety shields. 211

To obtain additional information on materials described on this page, see lower part of page 211-A.

Production of Starter Ring Gears Revolutionized by Electronic Process

Heat-treating Ring Gears by Electronic Process

ADAPTATION of electronics to production by the Studebaker Corporation has reduced the time of one step in the manufacture of automobile-starter ring gears from 2 1/2 hours to 20 seconds. Instead of heating the entire gear in a gas furnace for heat-treating, only the teeth, where extreme hardness is specified, are subjected to treatment. In addition to reduced production time, the application of this method produces a gear that will withstand four times the normal expectation of engine-starter shocks. It also results in fewer rejections in assembly, and safer, cleaner working conditions.

With the electronic heater, the ring gear is placed on a brass fixture inside the field of a two-layer coil. As the gear fixture spins at 75 R.P.M., high-frequency current reverses the magnetic field of the coil 540,000 times a second. This process sets up an agitation of molecules inside the gear teeth that engenders intense heat as it works gradually inward. Current is automatically shut off when the temperature of the teeth reaches 1500 degrees (within thirteen seconds), and a water spray from a surrounding tube drenches the part for seven seconds. Spinning of the work-holding fixture is continued during the entire drenching or quenching operation in order to insure even uniform hardening of the gear teeth.

Extra Clearance Provided at the Roots of Thread Ring Gages

Thread ring gages with substantial clearance below the roots of the threads, making it possible to take full advantage of the adjustment provided without the set plug coming in contact with the root of the thread, are being made by the Locke Gage Co., 10232 Woodward Ave., Detroit 2, Mich. Due to this clearance, the manufacturer states that it is now possible to lap the entire side of each thread from crest to root, because the thread lap extends into the clearance space. This permits reconditioning of gages far beyond their original life. The clearance space also serves as a receptacle for foreign particles which otherwise might become wedged between the actual thread surfaces.

* * *

The only foundation for wages and for a fair return on invested capital is production. The more and faster we produce, the lower the prices, the higher the wages, and the better the return on the investment. It is a matter of pulling together, not pulling in opposite directions.

Research Foundation Organized by Stevens Institute

Stevens Institute of Technology, Hoboken, N. J., has organized the Stevens Research Foundation, a non-profit corporation that will serve industry by carrying out research of a more fundamental nature than is customary in most company laboratories. Scientific and industrial research will be undertaken in cooperation with the college. The Foundation will operate with the aid of an advisory committee of industrial engineers and men outstanding as consultants in technical fields. The principal object of the Foundation will be to investigate fields pertaining to industry that will improve the technical and economic life of the country. It will not engage in routine test work, but will probably make many tests of universal interest, such as tests of heat-treating methods and wear qualities and, for example, studies on methods of surface-hardening gears. It will not attack problems of production, or the designing of production equipment for hardening gears for individual companies. Dr. Edwin G. Schneider, assistant to the president for research of Stevens Institute, will be executive vice-president and manager of the Foundation.

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

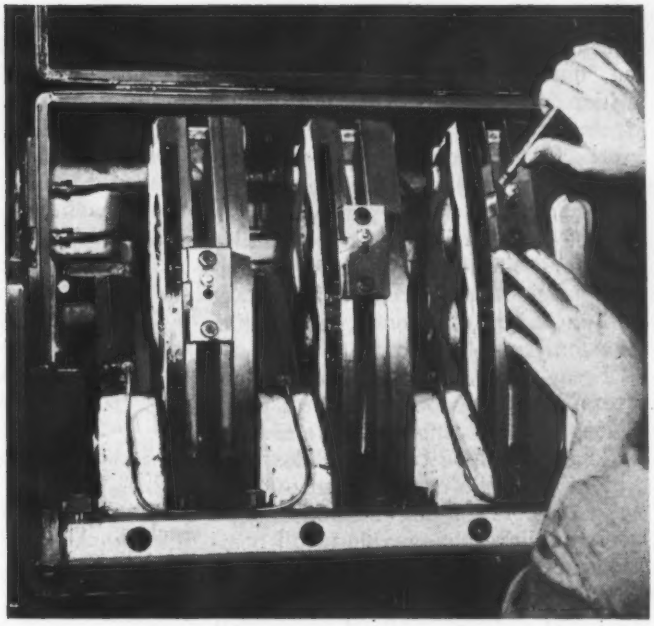


Fig. 2. Simple Sliding Adjustments for Length of Feed Strokes is a Feature of the New Warner & Swasey Automatic

Warner & Swasey Five-Spindle Automatics

A five-spindle automatic designed to reduce set-up time to the minimum and insure the maintenance of a high degree of accuracy on production work has been added to the line of precision machine tools built by the Warner & Swasey Co., Cleveland 3, Ohio. This machine is made in two sizes for handling bar stock up to 1 3/4 and 2 1/4 inches in diameter. A similar automatic with each of the five spindles equipped with a 6-inch chuck is also available.

Shockless indexing and locking of the spindle carrier with a high degree of accuracy by means of a novel mechanism is an outstanding feature of these machines. During the indexing movement, the spindle drum or carrier is lifted hydraulically, so that it rotates on a film of oil, which eliminates wear and thus serves to maintain accurate alignment. Provision for disconnecting the spindle-drum indexing mechanism permits setting the tools at any position without indexing through the cycle.

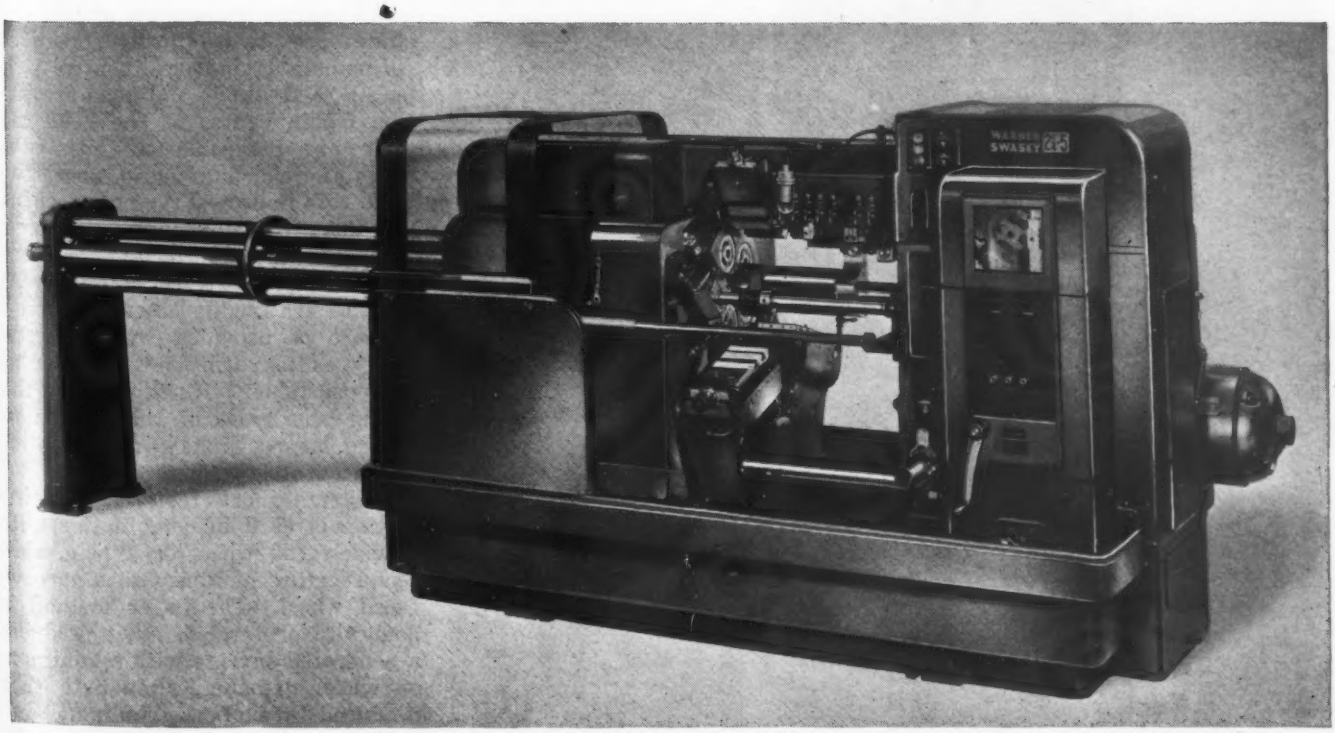


Fig. 1. Five-spindle Automatic Bar Machine Brought out by the Warner & Swasey Co.

To obtain additional information on equipment described on this page, see lower part of page 211-A.

The length of the feed strokes is mechanically controlled by a patented quadrant linkage arrangement which permits all working strokes from zero to maximum to be set quickly by making simple slide adjustments, as illustrated in Fig. 2. The cross-slide strokes are also controlled and adjusted in a similar manner. These quick stroke changing mechanisms are an important aid in obtaining economical production on small-lot jobs.

Four wide, rigid, independent cross-slides, a separate cut-off slide, a longitudinal center slide, and two independent longitudinal slides provide a versatile combination of easily accessible tooling stations. The tools are interchangeable in all positions; drilling can be done at all five stations; and tapping, threading, and reaming can be performed at three stations. Variable timing between longitudinal and cross-slide movements is obtainable.

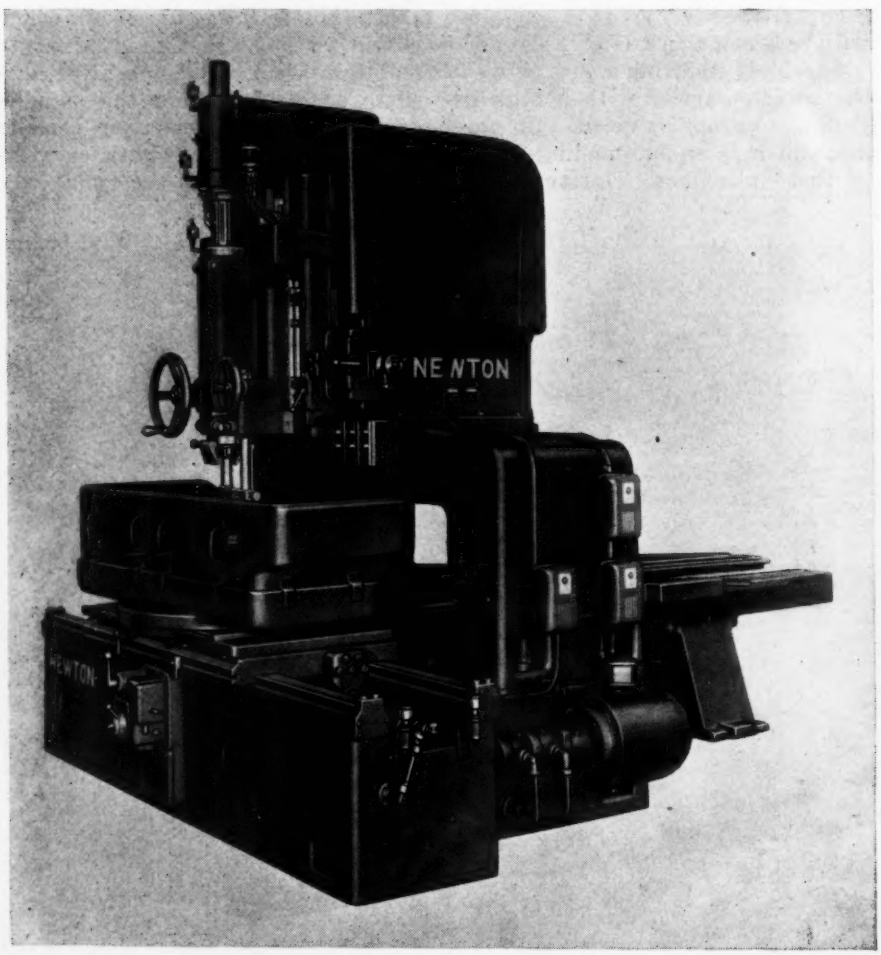
Pulsolator lubrication is employed for the spindle bearings to eliminate excessive heat from over-lubrication and to reduce coolant dilution. A low-pressure coolant system provides splashless flooding of the cutters, and a separate high-pressure system supplies coolant for chip-free deep drilling. The metal splash guards are mounted on anti-friction rollers. The 120-gallon coolant reservoir is equipped with strainers and sediment basin. The bar-stock carrier has sound insulation.

The turning stroke of these machines is infinitely variable between 0 and 5 inches, and the maximum length which can be turned by taking multiple longitudinal cuts ranges from 7 1/2 to 10 inches. The standard longitudinal idle approach stroke is 3 1/2 inches, but the machines can be especially equipped to provide an approach stroke of 2 1/2 or 5 inches. The bar feed stroke is infinitely variable from 0 to 10 inches, and the cross-slide stroke from 0 to 7/8 inch. The independent reaming stroke ranges from 9/32 inch to 4 1/2 inches.

Twenty-four spindle speeds ranging from 130 to 1414 R.P.M. are obtainable by eight sets of pick-off gears and a high-low shift operated by a lever. There are eighteen feeds which are instantly available through a quick-change selective gear-box. A convenient chart gives the actual feed, in thousandths of an inch, for each length of stroke from 0 to 5 inches. The machine is driven by either a 10- or a 15-H.P. motor operating at a speed of 1800 R.P.M. The drive-shaft speed is 720 R.P.M. The over-all length of the machine itself is 11 feet 2 inches, and the length with the bar-stock carrier is 18 feet; the width is 4 feet 6 inches. The machine weighs approximately 12,500 pounds, and the bar-stock carrier weighs 600 pounds. 61

Newton Radius-Link Grinding Machine

The Consolidated Machine Tool Corporation, Rochester 10, N. Y., has brought out an improved Newton heavy-duty radius-link grinding machine which is especially designed for grinding the radii of locomotive links and mating link blocks. When equipped with an extra rotary table attachment, internal bushing grinding work can also be easily handled. This machine has a vertical oscillating grinding head and reciprocating table, both operated by hydraulic cylinders. Individual motor drive is provided for the grinding spindle, and there is a separate motor pump unit for the hydraulic head and table movements.



Newton Locomotive-link Grinding Machine

All feeding movements of this machine are hydraulically operated. Adjustable trip-dogs control the length of the table and head strokes. The feeding rates of the head and table are independently adjustable while the machine is in operation. With this improved type of machine, the links to be ground are placed upon the table in a flat position, which simplifies work-handling. All controls are readily accessible. Rigid support is provided by the extra heavy radius arm and ball-bearing equipped table. With this equipment, the parallel sides of the block slots in the largest links can be rapidly and accurately ground.

Either a short, fast reciprocating motion is used in combination with a wide-faced wheel or a long, slow reciprocating motion with a narrow-faced wheel. The latter method is generally preferable, as it produces a generated surface with a minimum of wheel dressing, similar to that produced by surface grinding.

The spindle of the machine is belt-driven by a constant-speed totally

To obtain additional information on equipment described on this page, see lower part of page 211-A.

enclosed ball-bearing motor. The spindle head is fully counterweighted, and has an oscillating or continuous vertical reciprocating movement obtained by a hydraulic cylinder provided with means for selecting the desired rate of movement. The slide which supports the spindle head is adjustable horizontally by a handwheel equipped with a micrometer collar to facilitate setting the grinding wheel for the final cutting depth.

The spindle slide is gibbed to a heavy arch support designed to clear the radius arm, which swings on a fulcrum at the rear of the machine. The radius arm fulcrum can be set for grinding links from a minimum radius of 22 inches up to a maximum of 100 inches. Special provision can also be made, at extra cost, for handling links of larger radii. The work-table is 16 by 60 inches, and has a maximum travel of 36 inches.

The wheel-dressing device is so arranged that it can be quickly brought into position for dressing the grinding wheels. 62

Grayhill Demagnetizer for Small-Diameter Tools

A demagnetizer for small tools having diameters of 7/16 inch or less has been placed on the market by Grayhill, 1 N. Pulaski Road, Chicago 24, Ill. This unit measures only 3 inches by 1 3/4 inches by 3/4 inch, and operates on 115-volt alternating current. The demagnetizer is energized by depressing a switch button, and de-energized by releasing the button.

To magnetize a tool, such as a small drill, a coil is energized and the tool is passed completely through the hole of the demagnetizer. The coil is not de-energized until the tool is approximately 6 inches away from the demagnetizer. In cases where a drill, end-mill, or tool bit must not be removed from its chuck, the demagnetizer is slipped between the bed of the machine and the tool. The coil is then energized and the demagnetizer raised to the chuck with the tool centered in the hole, after which the unit is slowly lowered with the coil still energized until it is about 6 inches away from the tool.

The unit can also be used to magnetize an object as, for example, a screwdriver. This is done by depressing the switch button, placing the tool in the hole, and releasing the button before the tool is removed from its position. 63

Kearney & Trecker Combination Milling and Boring Machine

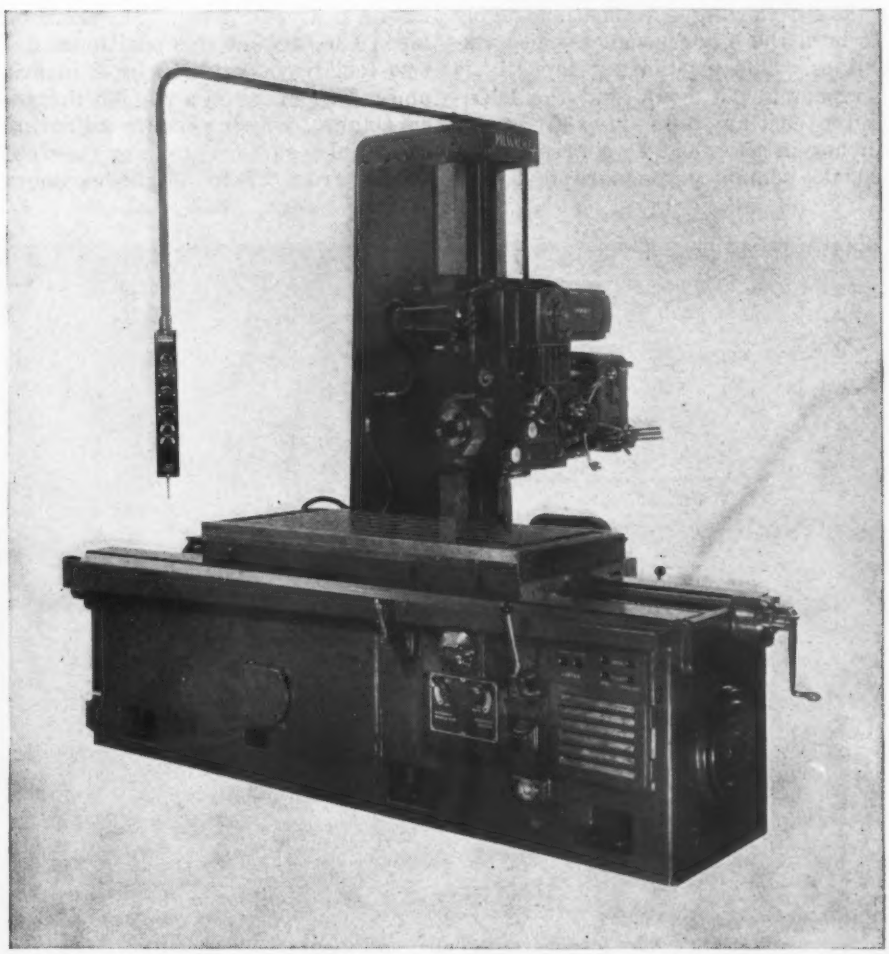
The Kearney & Trecker Products Corporation, Milwaukee 14, Wis., is now manufacturing a high-precision milling and boring machine identified as No. 3 Model T. With this new machine, precision milling, boring, and threading operations can be performed in one set-up on machine members, gear-boxes, box jigs, fixtures, and other production work.

Features of this machine developed to obtain a higher degree of accuracy include full support for the table throughout its travel and ram type construction of the spindle slide. This construction maintains accurate alignment, regardless of whether or not the slide is locked in position for milling operations or released to permit the use of boring feeds. A rear bearing extension eliminates overhang at the back end of the spindle ram, and supports the attached gear-box during the entire ram travel.

Operation is facilitated by placing a complete control unit on each side of the machine bed. Spindle rotation is electrically controlled through a swiveling pendant which contains switches for starting and stopping, forward or reverse traverse, inching, and applying the spindle brake. All controls for spindle speeds and boring feeds are placed in the spindle head. The entire range of spindle speeds is obtained through a single speed selector crank and a two-position range-change lever. Boring and threading feed changes are obtained by pick-off gears enclosed in the spindle head.

Since the longitudinal and vertical screws are used primarily for actuating the table and spindle head for milling feeds and rapid traverse, an end measuring system is supplied as standard equipment. All operating movements of the machine can be controlled to 0.0001 inch through built-in dial indicators. A four-position stop on the spindle ram facilitates step boring operations. Provision can be made for driving 16-, 20-, or 24-inch rotary tables.

The table has a working surface



Kearney & Trecker Combination Milling and Boring Machine

To obtain additional information on equipment described on this page, see lower part of page 211-A.

of 24 by 54 inches, and a longitudinal hand or power feed travel of 42 inches. The vertical spindle head travel by hand or power is 27 3/4 inches. Minimum and maximum distances from spindle center to table top are 1 1/4 and 29 inches, respectively. Column travel movement (by hand only) is 12 inches. Maximum and minimum distances from face of the spindle to table center line are 1 1/4 and 25 1/2 inches, respectively. The spindle speed range is from 35 to 1400 R.P.M. 64

Reed-Prentice Molding Machines

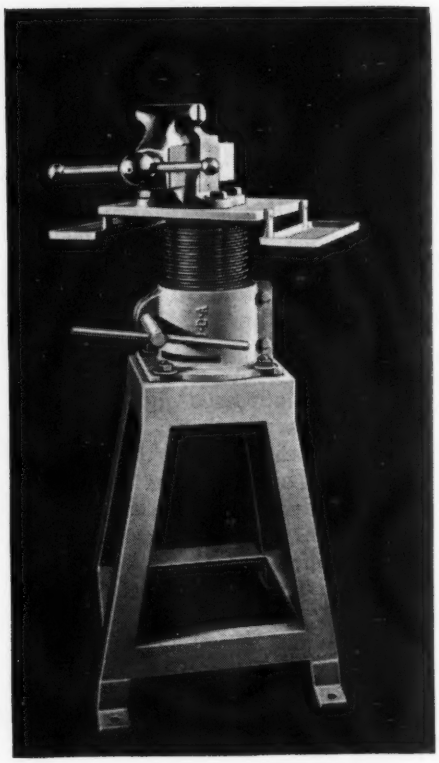
Improved injection molding machines, designated 10D-6 and 10D-8, with capacities for molding 6 and 8 ounces of plastic material per shot, have been developed by the Reed-Prentice Corporation, Worcester, Mass. Features incorporated in these improved machines include a one-piece welded steel base, easily removable guards, and a transparent plastic window for the safety door. A double shear-link mechanism is said to increase rigidity and reduce the maintenance costs. Hydraulic piping and valves are mounted outside of the base for accessibility. The electric timing clocks are mounted in dust-tight boxes. A rack and pinion are provided for quick adjustment of the clamping and injection units. The heater is wired with a plug-in connection.

The following specifications apply to both the 6-ounce and 8-ounce machines. The plasticizing capacity is 45 pounds per hour, and the maximum casting area is 100 square inches in the mold at a pressure of 20,000 pounds per square inch, depending upon the product and mold construction. The die plates are 21 by 25 inches, with a space between bars of 11 1/4 by 14 1/4 inches. Die space is 6 1/2 inches minimum and 16 inches maximum. Mold closing pressure is 250 tons. The feed hopper has a capacity of 50 pounds.....65

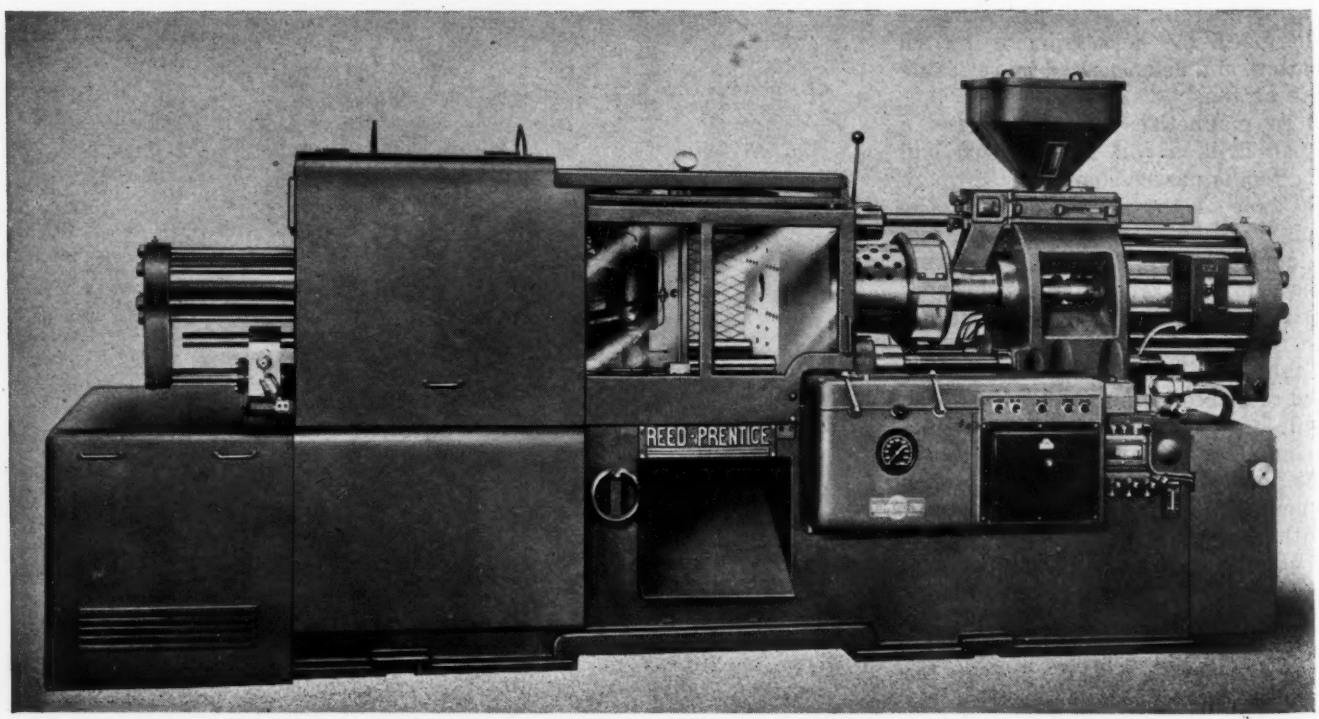
Portable Positioner for Supporting Vise

A positioner with a welded steel base and a metal fireproof table, 12 by 12 inches, on which a vise can be mounted and adjusted to the most convenient position for holding work on which filing, fitting, and welding operations are to be performed, has been brought out by the U.D.A. Co., 2807 N. Grand Blvd., St. Louis 4, Mo. The table of this positioner has two tool trays, each 12 by 4 inches, and is supported on a rugged threaded column, which permits adjusting the table surface to any desired height from 27 to 38 inches above the floor. Provision is made for locking the table in any position.

A ball-and-socket vise can be bolted to the table for use in handling work that requires repeated quick-changing of the angular position in a vertical plane. The complete table and base weighs 140 pounds. 66



Portable Work Positioner Made by the U. D. A. Co.



Plastic Injection Molding Machine Developed by Reed-Prentice Corporation

To obtain additional information on equipment described on this page, see lower part of page 211-A.

Landis Hydraulic Crankpin Grinder for Heavy Diesel-Engine Crankshafts

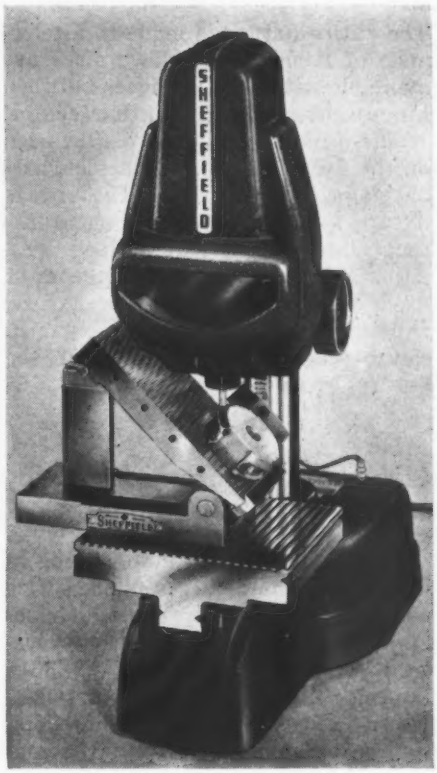
The Landis Tool Co., Waynesboro, Pa., has developed a 40- by 216-inch Type B hydraulic crankpin grinder designed for accurate high-production grinding of the pins and main bearings of large marine and locomotive Diesel-engine crankshafts. This new machine weighs 114,000 pounds, including the electrical equipment, and has the rigidity necessary for handling crankshafts up to 230 inches in length and weighing 7500 pounds. Such features as hydraulic work-table traverse, end wheel-spindle drive through multiple V-belts, and rapid electric wheelhead cross-movement mechanism incorporated in the earlier Type B plain grinder have been retained in the new machine.

The work-heads and drive are designed especially for handling very large crankshafts. The dual work-drive arrangement is designed to eliminate or minimize torsion deflection in the crankshaft. Power is transmitted from each work-drive motor through a combination multiple V-belt and silent chain reduction unit to a drive-shaft extending along the entire front of the machine. The speed of the work-drive motors is synchronized electrically, and is maintained by means of silent chains. A jogging handwheel on the drive-shaft in front of each head enables the operator to rotate the work in order to engage the fixture aligning latches. A grinding wheel 54 inches in diameter is mounted on the grinding head spindle.

The massive work-heads can be moved longitudinally on the work-table to accommodate shafts of varying lengths. A unique means of balancing the crankshaft is provided by extending both work-head spindles so that balancing weights that are adjustable on a slide can be attached to the outer ends of each spindle. Interchangeable throw blocks accommodate crankshafts having different main bearing diameters. Latches serve to hold the two fixtures in alignment while loading and unloading the work. Radial locating is accomplished by means of a revolving indexing plate or a fixed stop-plate.

Rapid grinding of the crankshaft cheeks is accomplished by a shoulder grinding attachment, which is designed for the rapid removal of as much metal as is required to true up the cheeks. Control of this attachment is by means of a handwheel. Grinding can be done from either left to right or right to left, the maximum movement being 1/4 inch.

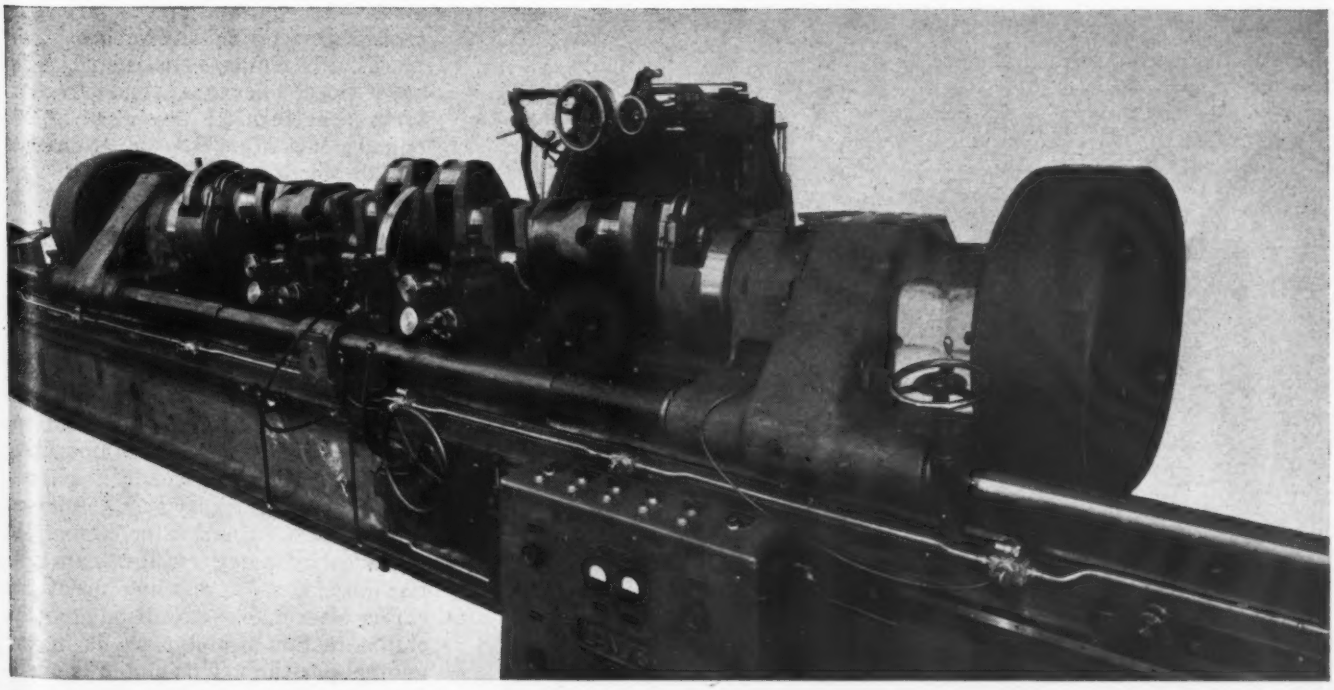
Centralized electric control is provided. Two ammeters enable the operator to determine whether the crankshaft is perfectly balanced before starting the grinding operation on a crankpin or cheek. 67



Sheffield 5-inch Sine-bar Mounted on Visual Gage

Sheffield Sine-Bar Fixture

A sine-bar fixture for accurately checking tapered and angular work has been brought out by the Sheffield Corporation, Dayton 1, Ohio. The fixture consists of a serrated work surface hinged to a baseplate.



Landis Hydraulic Crankpin Grinder Designed to Handle Large Marine and Locomotive Diesel-engine Crankshafts

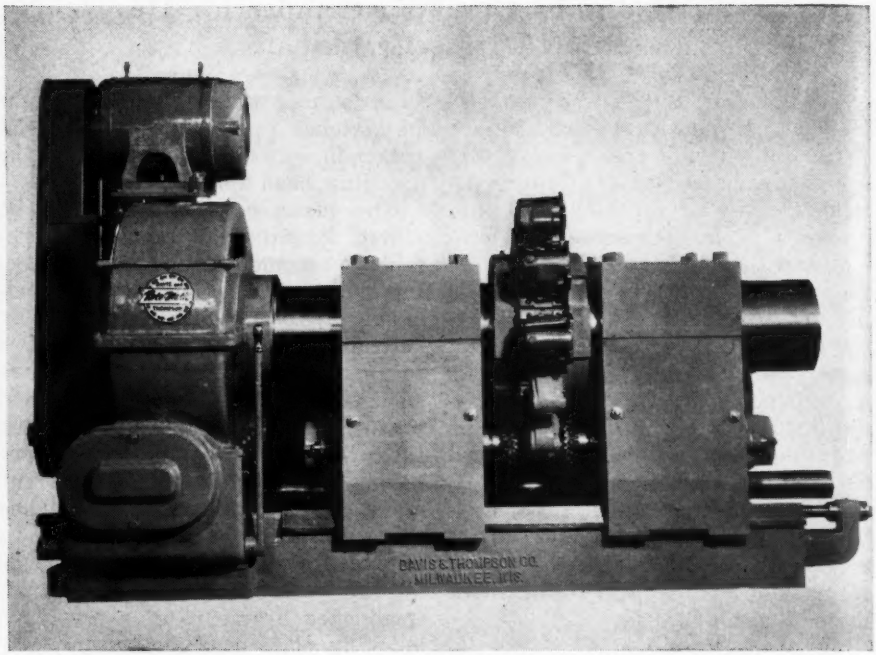
To obtain additional information on equipment described on this page, see lower part of page 211-A.

The entire fixture is made to a tolerance of 0.0001 inch. Two sizes are available with 5 or 10 inches between hinge center and setting bar center.

The 5-inch size fixture can be used on the 6-inch anvil of a Sheffield visual gage, as illustrated. Either size fixture is suitable for use on a surface plate with a height gage. An adjustable work-stop, which can be used on either end of the fixture, and an adjustable back-stop, which can be used on either side of the fixture, are provided. 68

Cleveland Horizontal Drilling and Tapping Machine

Production drilling and tapping of long pieces can be accomplished with a new horizontal, two-spindle combination machine built by the Cleveland Tapping Machine Co., 3610 Superior Ave., Cleveland 14, Ohio. Work-pieces up to 96 inches long can be accommodated, and the machine has a capacity for drilling holes and tapping National Coarse threads from 1/8 inch to 1/2 inch diameter in steel. A feature of the machine is that the work-piece can be indexed to the tapping position after drilling, thus eliminating the possibility of misalignment due to handling. Each spindle is said to be held within a 0.010-inch tolerance on horizontal travel. The spindles are independently adjustable for depth of travel. 69

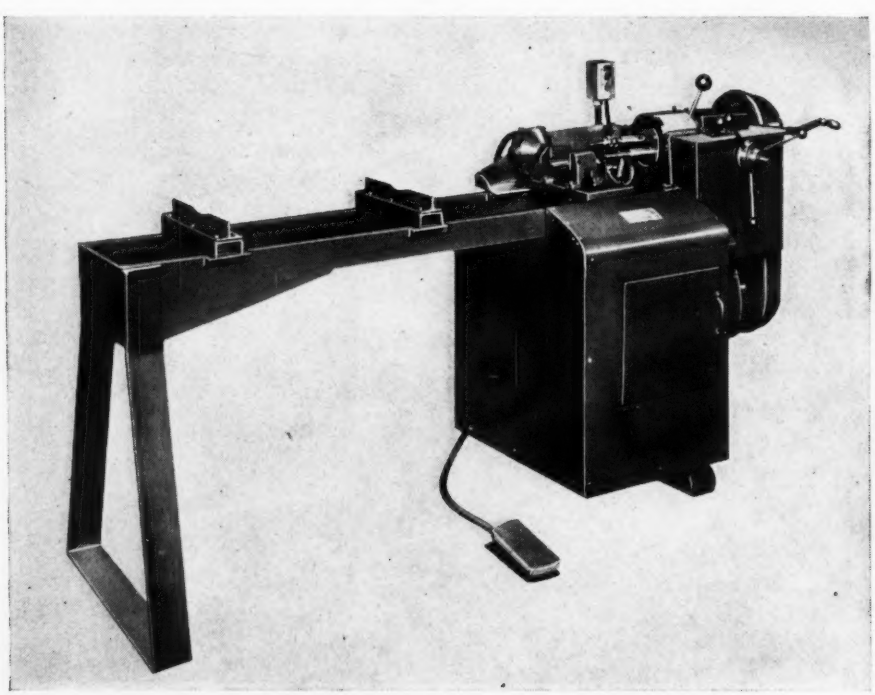


Roto-Matic Miller Designed for Milling Parallel Faces of Transmission Cases

Davis & Thompson Roto-Matic Miller

A No. 2-B Roto-Matic milling machine designed for continuous milling of the parallel faces of transmission cases, in which the work-pieces are automatically clamped and located, has just been brought out by the Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis. Rotation of the work-drum carries or feeds the work past the roughing cutters and the finishing cutters successively. The milling operations are completed in one rotation of the work-drum.

The work-drum has twelve stations which insure a continuous flow of pieces past the cutters. Micrometer adjustment is provided for each spindle, which is readily accessible from the outside of the heads. Both heads of the machine can be adjusted on the ways to accommodate transmission cases of different sizes. Speeds and feeds are controlled through change-gears. The machine is rigidly constructed to insure close tolerances and freedom from chatter. It weighs 26,300 pounds, has a gross production rate of 126 pieces per hour, and is 16 feet long, 6 feet wide and 8 feet high...70



Cleveland Horizontal, Two-spindle Drilling and Tapping Machine for Long Work

Safety Clutch with Automatic Overload Release

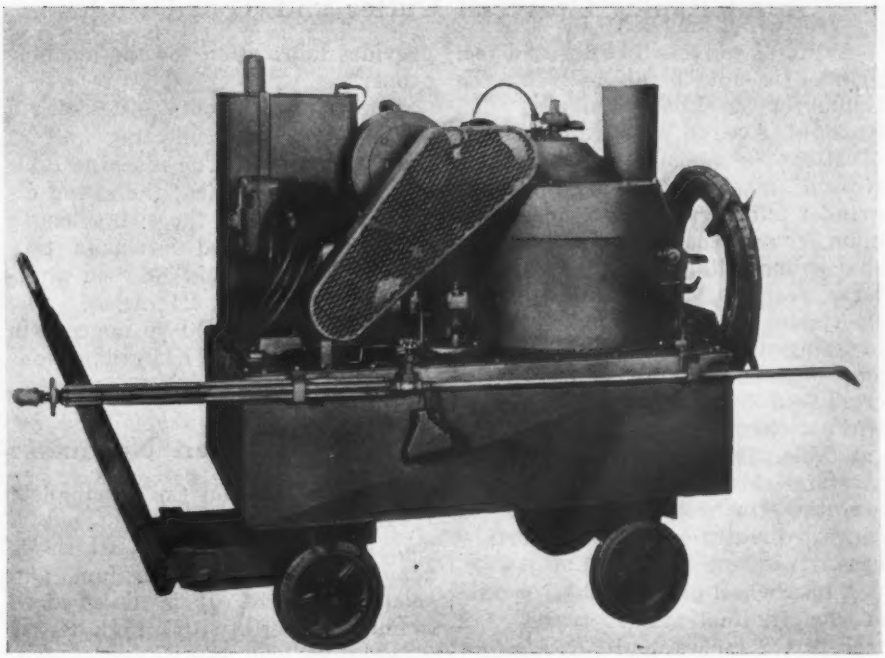
An overload "Maxitorq" release clutch, designed to meet requirements where quick automatic disengaging of the clutch is imperative in case of an overload, has been brought out by the Carlyle Johnson Machine Co., Manchester, Conn. In the event of an overload, a cam acting against a pin on the side of the clutch sleeve serves to disengage the clutch instantly and place it in the neutral position. This clutch is available in four regular sizes with sleeves ranging from 3 7/8 to 6 3/4 inches outside diameter. 71

To obtain additional information on equipment described on this page, see lower part of page 211-A.

Oakite-Vapor Cleaning Unit

A new multiple-duty steam cleaning unit designed for fast, efficient, and economical cleaning of machines, parts, containers, and a large variety of other products has been developed by Oakite Products, Inc., 26 Thames St., New York 6, N. Y. This equipment, known as the "Oakite-Vapor" cleaning unit, consists of a self-contained, down-draft flame, oil-fired, enclosed-coil type steam generator, which delivers hot, vaporized cleaning solutions under selective pressures up to 200 pounds for removing grease, grit, paint, and other deposits from the work surfaces. The unit can be operated on a wide range of fuel oils, including No. 1, 2, or 3 fuel oil, kerosene, or gasoline. The flexibility of the control over steam pressures makes the unit well adapted for many different types of light- and heavy-duty cleaning.

The unit is built to withstand long, continuous service, and has ample reserve power, which can be uniformly applied. Simplicity and ease of operation and maintenance, rapid steam generation, large solution tank capacity, and facilities for operating two steam guns simultaneously are outstanding features of this unit....72

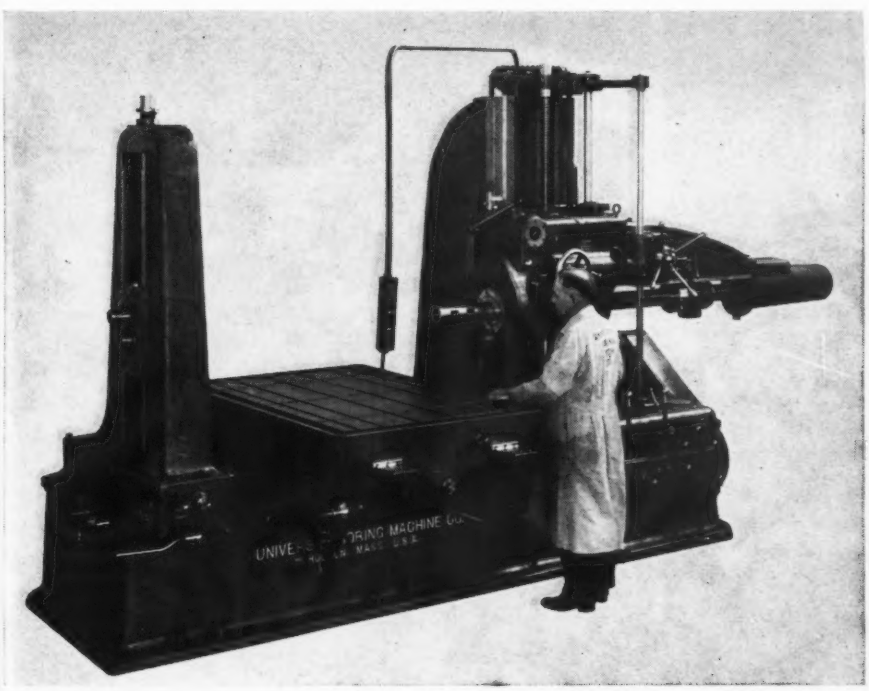


Oakite Multiple-duty Steam Cleaning Unit

Milling, Drilling, and Boring Machines

A line of horizontal table type milling, drilling, and boring machines has been announced by the Universal Boring Machine Co., Hudson, Mass. The machines are made in two sizes, the 4-inch spindle size with a speed range of 8 to 1000 R.P.M., and the 5-inch spindle size with a speed range of 7 to 850 R.P.M.

Both sizes of machines are available with vertical ranges of 36, 48, or 60 inches; faceplate to outer support dimensions of 72, 96, or 120 inches; and with tables 40 by 60, 42 by 72, or 48 by 84 inches in size. Electrical equipment consists of a 20-H.P. motor, which is controlled through a swinging type pendant push-button providing forward, forward jog, reverse, reverse jog, and stop positions. 73



Horizontal Table Type Milling, Drilling, and Boring Machine Developed by the Universal Boring Machine Co.

Fonda Carbide Gage-Blocks

The Fonda Gage Co., 59 Daly St., Stamford, Conn., has just placed on the market a No. 82-C tungsten-carbide set of gage-blocks. This set of eighty-two pieces is comparable in quality to the thirty-five piece tungsten-carbide set described in November, 1945, MACHINERY, page 204. The manufacturer claims that, for all practical purposes, these tungsten-carbide blocks are immune to wear, and under normal shop conditions need never be replaced.

They are made to an accuracy exceeding the U. S. Bureau of Standards' requirements for gage-blocks, and are available in both standard and metric sizes. The standard sizes range from 0.050 inch to 4 inches. The sets are available in Grade AA, which has an accuracy of plus or minus 0.000002 inch; Grade A, which has an accuracy of plus or minus 0.000004 inch; and Grade B, which has an accuracy of plus or minus 0.000008 inch. 74

To obtain additional information on equipment described on this page, see lower part of page 211-A.

Grand Rapids Universal Cutter and Tool Grinder

A No. 60 universal cutter and tool grinder is now being built by the Gallmeyer & Livingston Co., 305 Straight Ave., S.W., Grand Rapids 4, Mich., to replace the company's No. 6 machine. This improved grinder is designed to provide maximum convenience of operation in sharpening milling cutters, gear cutters, reamers, and similar tools. Provision is made for raising and lowering the grinding wheel head and column, and for actuating the cross-feed for the head and column without changing the position of the sub-table. This permits the operator to stand close to his work, and allows the attachments and work to be carried directly over the supporting base.

A handwheel provides three speeds of longitudinal table travel—1/2 inch, 3 1/2 inches, and 8 1/4 inches per revolution. It can be operated from either the right- or left-hand side of the machine. The vertical movement of the head is controlled by a handwheel mounted on the top of the column, which can be swiveled and locked in the most convenient operating position.

An anti-friction table is standard equipment, and the sub-table ways on the base are provided with guards, as illustrated. The machine is equipped with a precision ball-bearing cartridge type spindle which requires no lubrication for the life of the bearings. A one-shot system provides lubrication for the machine proper.

The grinder is obtainable with a motor-driven dust-collecting unit of the Cyclone type. The machine table is 5 1/2 by 38 inches; the swing diameter, 12 inches; the swing length between right- and left-hand tailstocks, 27 inches, and between work-head and tailstock, 24 inches. The table can be swiveled 90 degrees in either direction, and has graduations at one end for taper settings up to 3 inches per foot. The swivel plate is graduated to 360 degrees.

Spindle speeds ranging from 2850 to 5800 R.P.M. and work-head speeds of 265 and 370 R.P.M. are available. Internal spindle speeds range from 9100 to 18,500 R.P.M. The vertical feed per graduation is 0.001 inch, as is also the cross-feed. The spindle is driven by a 3/4-H.P., 1750-R.P.M. motor. The complete machine requires a floor space of 72 1/4 by 58 inches, and weighs 2250 pounds.....75

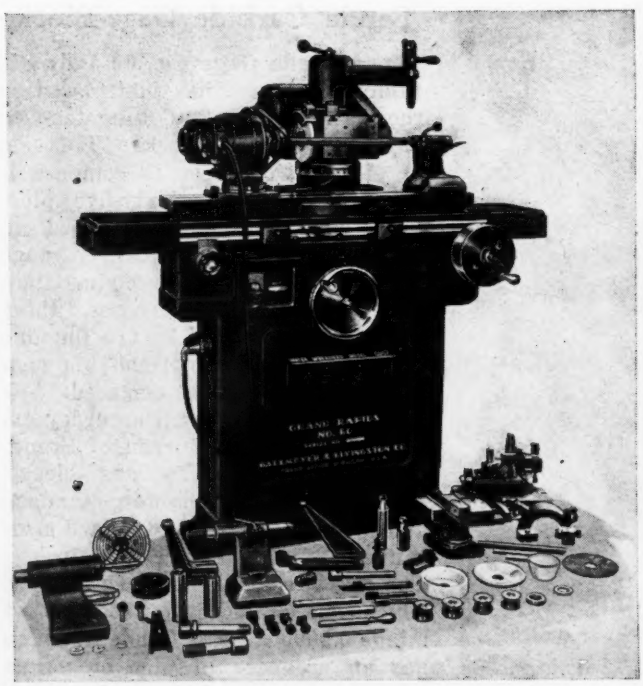
Van Norman Horizontal Miller

The Van Norman Co., Springfield 7, Mass., has just brought out a No. 2 horizontal miller which is adapted for milling medium and small size parts. It is designed to combine strength with a high degree of accuracy and sensitivity of control. The spindle is equipped with a heavy flywheel to insure a smooth, uniform drive for the cutter. This and other features are similar to those incorporated in the heavy No. 2 machine described in November MACHINERY, page 198, and the No. 3 machine described in the December issue, page 204.

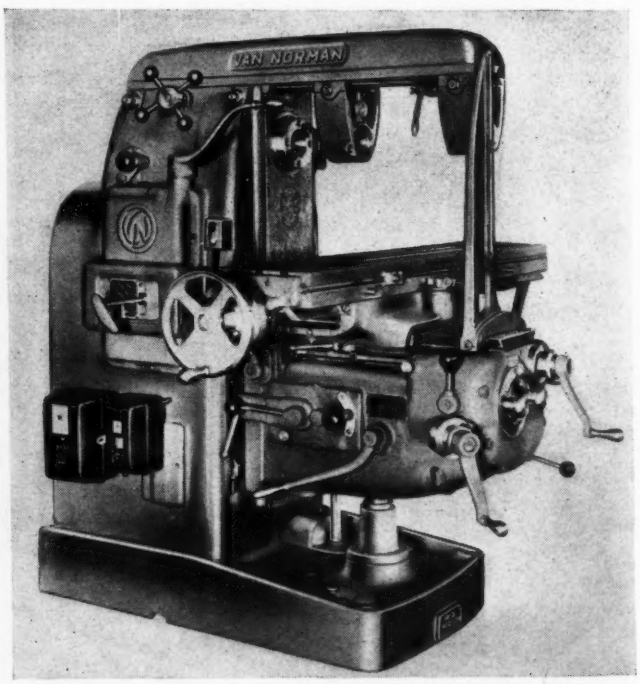
The table of this machine is 50 by 10 inches, and has a longitudinal feeding range of 28 inches, a cross-feed of 10 inches, and a vertical feed of 17 inches. The eighteen spindle speeds available cover a range of from 30 to 1500 R.P.M., and the twelve feeds range from 0.5 inch to 36 inches. Adequate power is provided by a 5-H.P. motor. The machine weighs 4000 pounds, and is available with either a plain or a universal saddle. Standard equipment includes a draw-in bar and coolant system. 76

Cupro-Arc Electrode

A new type of phosphor-bronze electrode for use in the all-position welding of brass, bronze, copper, cast iron, and steel has been added to the line of the Alloy Rods Co., York, Pa. This electrode, known as "Cupro-Arc C," is designed for operation with direct current and reverse polarity. It conforms to the A.W.S.-A.S.T.M. specification E.Cu-2A, and will also meet Navy specifi-



Grand Rapids Universal Cutter and Tool Grinder of Improved Design



Van Norman Horizontal Miller Adapted for Medium and Small Size Work

To obtain additional information on equipment described on this page, see lower part of page 211-A.

cation 46-E-5 requirements for Grade II electrodes.

Typical applications include the repair and maintenance of bushings, bearing surfaces, castings, gears, propellers, and piping; fabrication of copper-clad metals; and welding of dissimilar metals, such as bronze to brass, cast iron to steel, bronze to steel, and bronze to cast iron.....77

Yankee Precision Electric Surface Gage

The Yankee Precision Products Co., Hartford 10, Conn., has developed an entirely new type of automatic visual indicating electric surface gage designed for quick and accurate measuring of the flatness of machined surfaces to extremely close tolerances. While the size and shape of the piece being gaged will determine to a certain extent the factor of accuracy, test recordings of typical pieces are said to have indicated that variations of as little as 0.000005 inch can be measured.

The gage consists essentially of a work-table with a surface formed by closely spaced rest buttons, arranged to duplicate the form and area of the piece to be gaged. The tops of these buttons are precision ground and lapped to form an accurate, flat resting surface, and each button is connected electrically to a small light bulb similarly placed in a duplicate of the face of the gage, which is mounted above the work-table, facing the operator.

In operation, the work-piece is placed on the surface of the gage, and in the case of perfect over-all accuracy, all the electric bulbs are illuminated. Where there are high or low spots, the bulbs in the corresponding positions on the duplicate work pattern will not light. The percentage of inaccuracy will be simultaneously indicated by an electric meter connected to that segment of the gage surface. 78

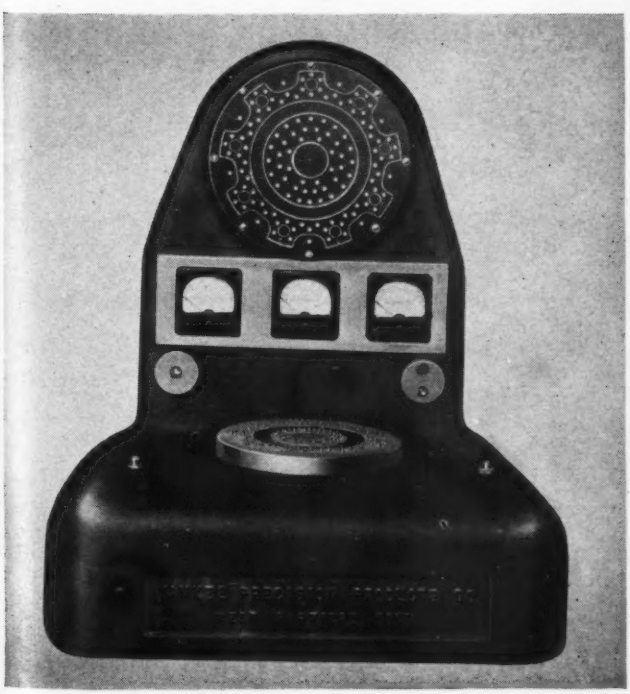
Oxweld-Unionmelt Machine Carriage

A new heavy-duty straight-line welding machine carriage known as the Oxweld-Unionmelt CM-37 has been developed by The Linde Air Products Company, Unit of Union Carbide and Carbon Corporation, 30 E. 42nd St., New York 17, N. Y. This carriage can be used for carrying Unionmelt electric welding equipment, the CMA-21-B attachment for plate-edge preparation, single- or multiple blowpipe set-ups for straight-line cutting, flame-hardening equipment, and the Oxweld C-45 blowpipe for cutting extra heavy sections. Although the carriage is designed for heavy-duty work, its weight, without equipment, has been held down to 87 pounds through the use of aluminum alloys.

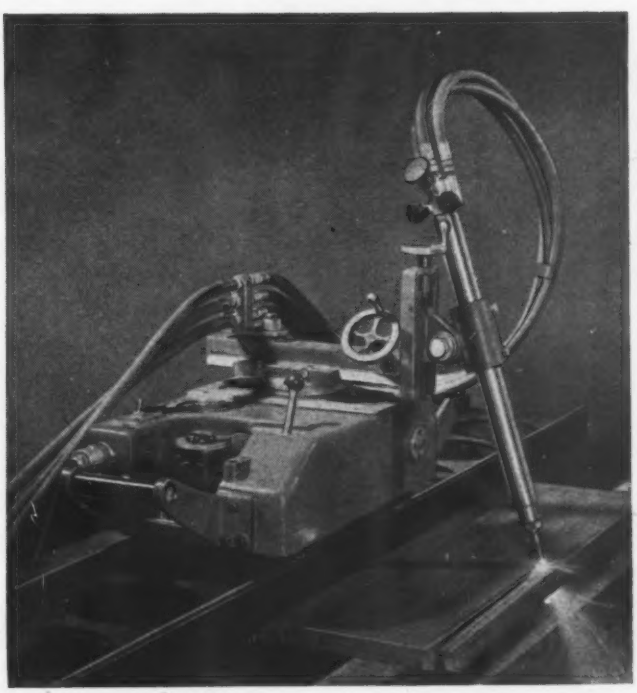
The carriage is 32 inches long, 12 1/2 inches wide, and 9 inches high, plus an additional 2 7/8 inches for the "forward-reverse" control lever. It is equipped with a 110-volt alternating-current uni-directional 1/4-H.P. motor. Reversing is accomplished mechanically through gears. The carriages are supplied with speed ranges of 2 to 50 inches per minute for general industrial use, and 7 to 210 inches per minute for use with the Unionmelt welding process. An electrical speedometer indicates the welding speed. When accuracy of travel is not important, the carriage can be operated on a standard 10-inch, 25.4-pound I-beam. It also can be operated directly on the steel plate or other flat work...79

Diamond Lapping Powder and Powdered Metal for Setting Diamonds

The National Diamond Hone & Wheel Co., 108 Fulton St., New York 7, N. Y., has placed on the market a diamond powder for honing and lapping which is the same as that used in the honing stones made by this company. A specially developed process is employed to obtain uniform particle or grain size of the diamond powder, which conforms to the Bureau of Standards specifications.



Precision Electric Surface Gage Brought out by the Yankee Precision Products Co.

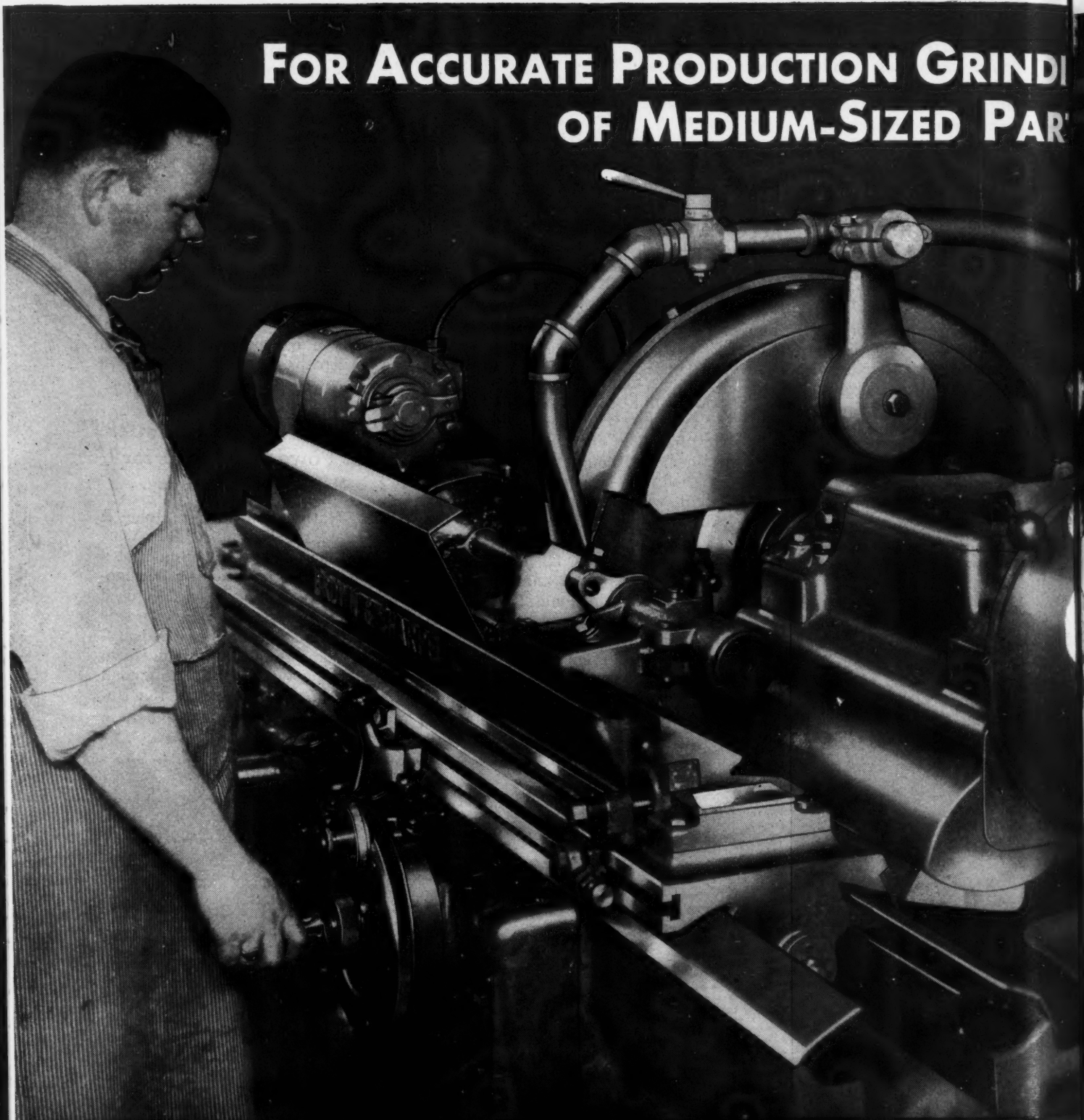


Oxweld-Unionmelt Machine Carriage with a Blowpipe Set at Angle for Bevel Cutting

To obtain additional information on equipment described on this page, see lower part of page 211-A.

USE NOS 10 AND 12

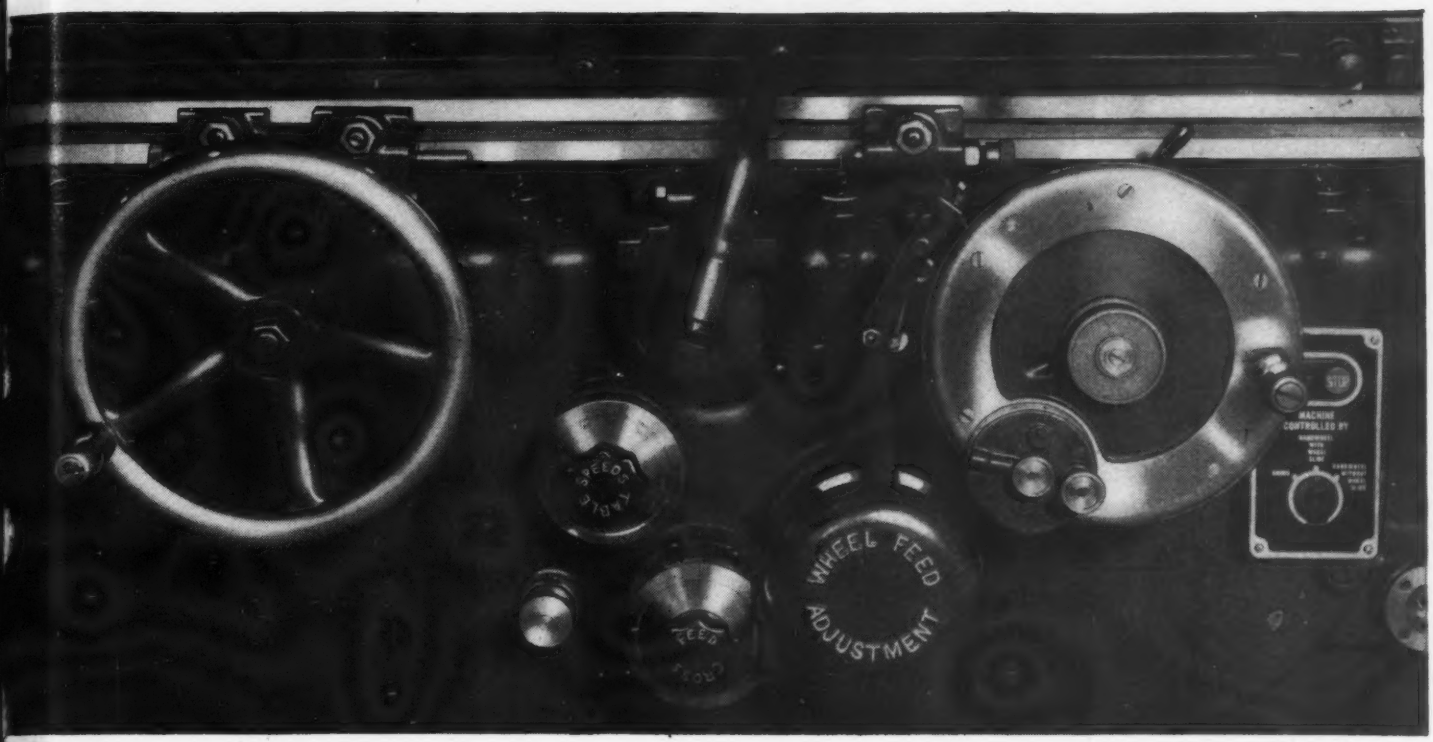
FOR ACCURATE PRODUCTION GRINDI
OF MEDIUM-SIZED PAR



TRAVERSING OR PLUNGE-CUT GRINDING
– – to *unusually* close limits

BROWN &

IMPLE CONTROLS *for* EFFICIENT OPERATION



For Quick Set-Up

MANUAL CONTROL— with starting and stopping of headstock and table governed by knobs.

Rate of table speed — Period of table dwell — Selection of traversing or straight-in-feed grinding — Automatic wheel feed (rate and point of throw-out) — Wheel truing control . . . all set from the operating position.

For Fast Production

SEMI-AUTOMATIC CONTROL— obtained by simply turning a knob which centralizes control in cross feed handwheel.

Slight counter-clockwise rotation then **advances** grinding wheel and starts headstock and coolant pump — clockwise rotation of handwheel (after cross feed is automatically stopped) **withdraws** grinding wheel and stops headstock and coolant flow . . . wheel slide rapid travel gives an extra 2" wheel withdrawal for convenience in loading and unloading work.

Ask for details on these productive Plain Grinding Machines — No. 10 (6" x 18") and No. 12 (6" x 30").

BROWN & SHARPE MFG. CO.
PROVIDENCE 1, R. I., U. S. A.

SHARPE

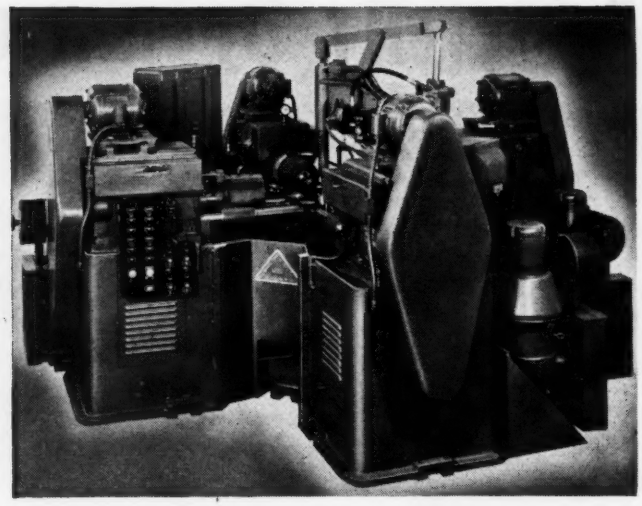


Fig. 1. LeMaire Special Hollow-milling Machine Equipped for Machining Universal Joint Spiders

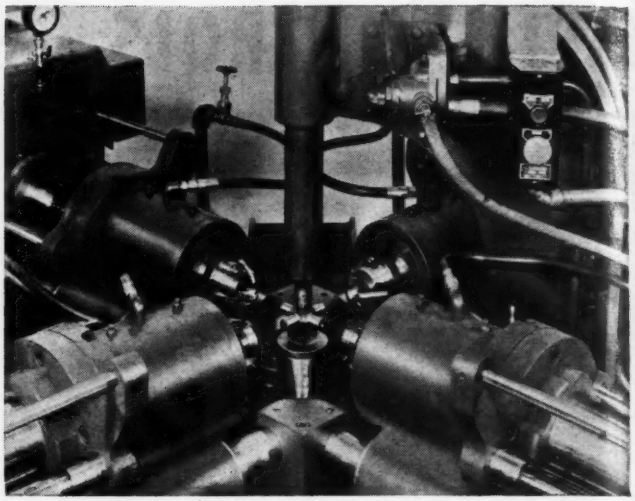


Fig. 2. Close-up View of Hollow-milling Cutters and Work Handled on Machine Shown in Fig. 1

This company has also developed a powder containing copper and nickel with titanium hydride, known as "Powder Metal Mix," for setting diamonds in their holders by a sintering process. It is claimed that diamonds set with this mixture are held securely and will not work loose or become lost. 80

Logan Air Regulating, Filtering, and Lubricating Unit

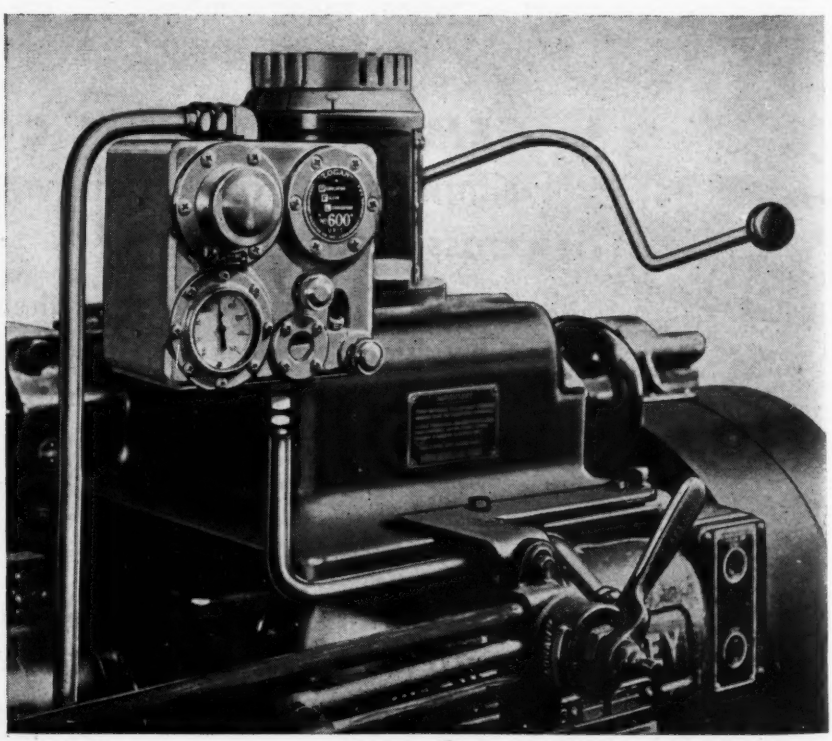
A device known as the Logan R-F-L unit, which is designed to insure efficient performance and increased life of machines, tools, and other equipment operated by compressed air, has been developed by the Logansport Machine Co., Inc., 910 Center Ave., Logansport, Ind. This unit comprises a compact casting, measuring 6 inches square by 4 3/4 inches deep, which contains the assembly of reducing valve, pressure gage, filter, and lubricating device. A panel with adjusting controls and gages is mounted on the front of the unit, which can be applied to old or new equipment.

In operation, the unit performs three functions: First, it regulates the air pressure, and thus provides smooth, uniform actuation of the equipment; second, it filters the air to separate rust, scale, or other foreign matter and water from the air to insure unfailing operation and to reduce wear; and third, it lubricates the working parts of the air equipment by automatically injecting a continuous oil mist into the air supply line. This minimizes wear and protects cylinders, valves, and tools against rust and corrosion. 81

LeMaire Heavy-Duty Hollow-Milling Machine

A new machine designed for heavy-duty hollow-milling operations has been developed by the LeMaire Tool & Mfg. Co., 2657 S. Telegraph Road, Dearborn, Mich., and equipped for machining universal joint spiders. This special-purpose machine is built up of several standard elements, as shown in Fig. 1. Each of the four milling units is driven independently by a LeMaire No. 5000 hydraulic unit mounted on a standard base. All four bases, arranged at right angles to each other, are joined to a central base which carries the special work-holding fixture. Each unit is a machine in itself, and can be operated independently of the others. Stepless feeds are controlled by a flow valve, and the spindle speeds are adjusted by a rheostat located on a variable-speed unit which is positioned within convenient reach of the operator.

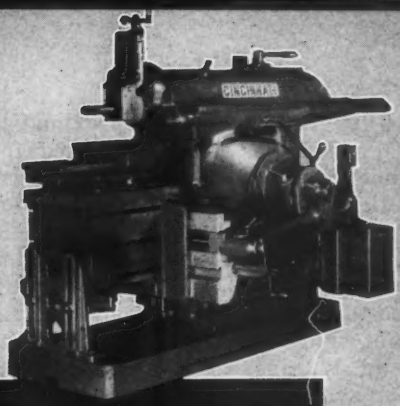
Since separate motors are employed to furnish power for the hydraulic pumps and spindles of this machine, any change in the speed of one does not affect the speed of the others. The heavy-duty spindles are

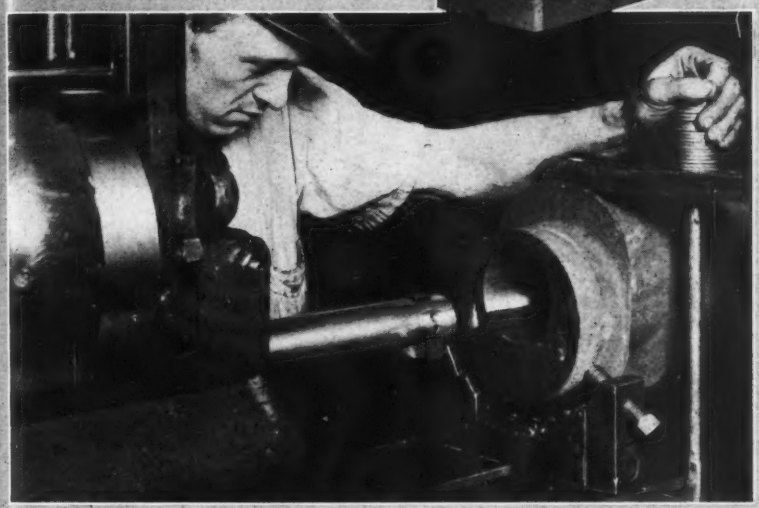


Logan R-F-L Unit Installed in Air Intake Line of Turret Lathe

To obtain additional information on equipment described on this page, see lower part of page 211-A.

Use a SHAPER





INTERNAL SHAPING

In or out of the tool room, a Cincinnati Shaper is a dependable tool.

Planing, shaping, contouring, internal shaping, angular shaping, or universal work, are all done on this multi-use machine.

Set-up is simplicity itself.

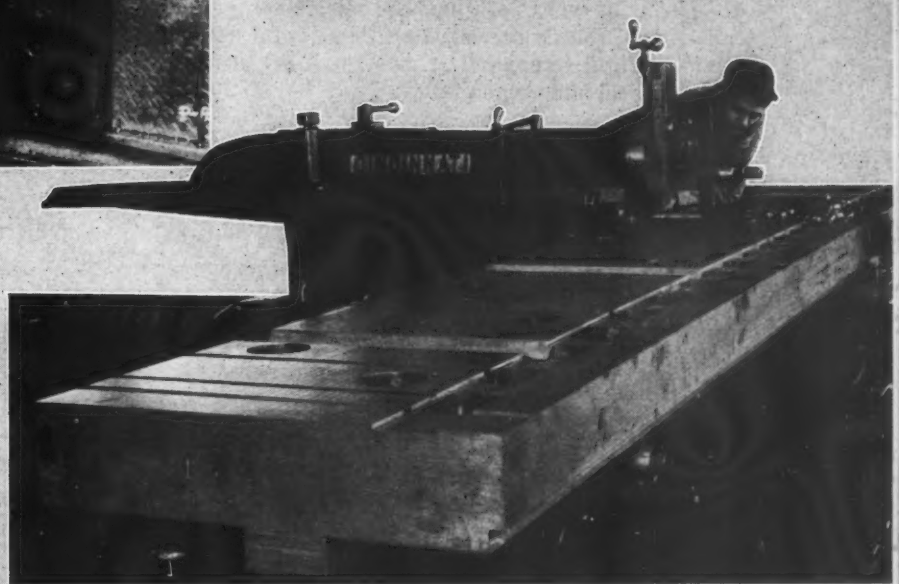
The power, speed and accuracy of Cincinnati Shapers make them efficient for small-lot manufacturing.

Cincinnati Shapers are profitable tools in any shop.

Write for Catalog N-3, and the practical Bulletin — Set-ups on Cincinnati Shapers.

CONTOURING

ANGULAR SHAPING



PLANING AND SHAPING

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

mounted on rigid housings which slide on large guide bars. Coolant under high pressure is forced inside the spindle to provide efficient chip removal.

The air-operated fixture has an electric interlock to prevent the operation before the part is clamped. A nest arrangement for locating the part in the fixture, as shown in Fig. 2, facilitates changes in work set-ups. Production of approximately 180 pieces per hour is claimed for spiders such as shown in the work position in Fig. 2. The journals of these spiders are 3/4 inch long and 3/4 inch in diameter. This machine can be equipped for hollow-milling and facing the shoulders on universal joint spiders with journals ranging from 1/2 inch to 1 1/8 inches in diameter. ---------- 82

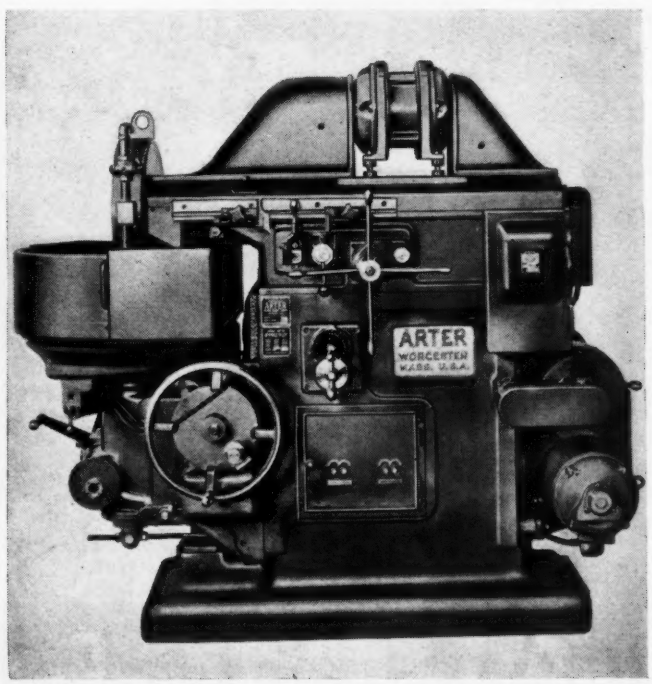
Arter Rotary Surface Grinders

A model D rotary surface grinder in which improvements designed to obtain a high degree of accuracy and fine finish have been incorporated has recently been added to the line of precision grinders built by the Arter Grinding Machine Co., 15 Sagamore Road, Worcester, Mass. A precision balanced motor mounted directly on the wheel-slide of this machine delivers its full power to the wheel-spindle. The wheel-spindle is positioned on the slide with its axis in the same horizontal plane as the slide ways, which increases the stability of the slide. The spindle drive is by multiple V-belts, the belt tension being maintained by adjusting screws under the motor foot.

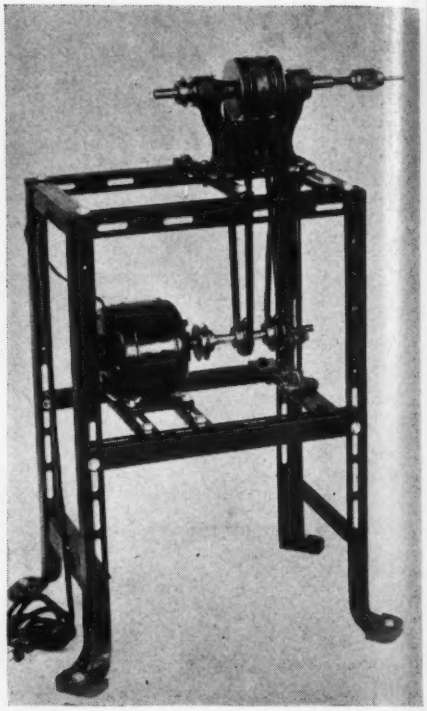
The wheel-slide is moved hydraulically on flat and vee ways by the piston-rod positioned in the same horizontal plane as the ways, which are automatically pressure-lubricated. The wide ways of the base extend beyond the front wall, and thus provide rigid support for the wheel-slide when it is extended over the work. Movement of the slide, including reversal, is controlled by a single lever. Reversal can be automatically and accurately controlled by adjustable dogs. Hand-feed is also provided through the capstan, pinion, and rack.

The knee or work-table slide is raised and lowered by a handwheel and by hydraulic means. The drive to the chuck spindle is by an electric Vari-Drive unit equipped with a remote-control handwheel. A brake is provided for stopping the chuck. The work-spindle housing can be tilted for grinding interior or exterior conical surfaces on circular work. The magnetic chuck is designed to hold small parts. The 55-gallon coolant tank is mounted on the floor behind the grinder. A 1/4-H.P. three-phase motor serves to drive the coolant pump, and the oil-pump is driven by belt from the chuck spindle.

The machine is available in 12- and 16-inch sizes having magnetic chucks with surface diameters of 13 and 17 inches. The vertical capacity, when using a wheel 14 inches in diameter, is 9 inches for each size machine. The maximum swing inside the water-pan is 20 inches. The work-table can be tilted 10 degrees for convex and concave grinding. Chuck spindle speeds are 60 to 250 R.P.M. A 5-H.P. wheel-head motor and a 2-H.P. chuck driving motor are employed. Each machine requires a floor space of 84 by 60 inches. The 12-inch machine weighs 6000 pounds, and the 16-inch machine 6200 pounds. ---------- 83



Arter Improved Surface Grinder



Star Tapping Machine with Friction Horizontal Drive

Friction-Drive Tapping Machine

Samuel S. Gelber, 32 S. Jefferson St., Chicago 6, Ill., has brought out the Star friction horizontal drive tapping machine here illustrated. The friction drive is said to be simple in design and operation. The motor mounting is adjustable for belt tension and to permit using any make of fractional-horsepower motor. The spindle is mounted on bronze bearings. A 3/8-inch capacity three-jaw keyless chuck, the necessary belts, motor, toggle switch, and 8 feet of cord are furnished with the machine. ---------- 84

Weld-Spatter-Resistant Compounds

The weld-spatter-resistant compounds, identified as Nos. 9951 and 9952, have been placed on the market by the Electric Welding Division of the General Electric Co., Schenectady 5, N. Y. Both of the new compounds are especially intended for use where weld spatter must be

To obtain additional information on equipment described on this page, see lower part of page 211-A.

The Link-Belt Company of Philadelphia says: "The capacity of this Cincinnati Bickford Super Service Radial Drill enables us to drill and tap Marine Gear Reduction Units of 1000 h.p. complete. It has the power to handle the largest drills required and the sensitiveness to tap holes as small as ¼".

"The power rapid traverse reduces physical effort on the part of the operator and increases production. This machine has proven very satisfactory on all work of this character."

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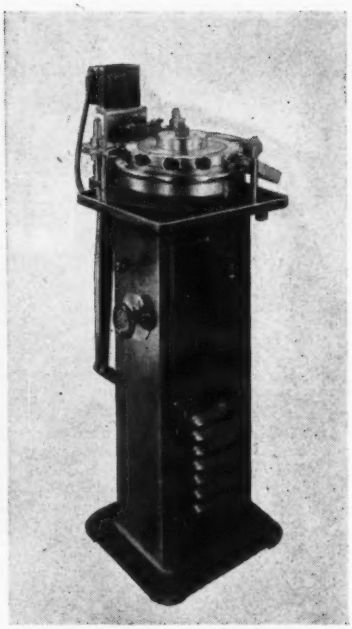
avoided. The compounds are furnished in powdered form, ready to be mixed with water. A feature of these compounds is that the surface of the work, even though slightly oily, does not require wetting before the compounds can be applied. Another feature is that a special ingredient in the compounds eliminates the necessity for using a water soluble binder in order to obtain adhesion. ---------- 85

Gray-Mills Cleaning Systems

Three new systems for cleaning parts in industrial plants have just been placed on the market by the Gray-Mills Co., 1948 Ridge Ave., Evanston, Ill. The Model H-71 general utility unit, shown to the right in the illustration, has been developed to succeed the earlier Model P-70. The new unit has a centrifugal pump for "hose-cleaning" parts and for agitating the cleaning bath to accelerate the cleaning either of large parts or of small parts contained in baskets. A means for air agitation is also provided. A safety device causes the cover to close automatically in case of fire. This model is 38 inches long by 21 inches wide.

The Model J-75, shown to the left, is 60 inches long, 34 1/2 inches wide, and 33 1/2 inches high. This model is equipped with a high-volume, high-pressure rotary pumping unit for the hose-cleaning of motor blocks and other large parts. The pumping unit is portable, and can be used as a general-purpose transfer pump for solvents, oils, etc. This model is also equipped for agitating the cleaning fluid.

The smallest of the three units—the Model L-73—shown in the central view of the illustration, is 21 inches long, 21 inches wide, and 34 1/2 inches high. Being mounted on casters, this model is easily portable. It is frequently used for the special fast-acting type of solvent, such as "Speed-Agitene," supplied by the maker for cleaning carburetors, fuel pumps, etc. These units are also adapted for cleaning operations on automotive and aviation parts, farm implements and machine parts, and dies and tools. ---------- 86

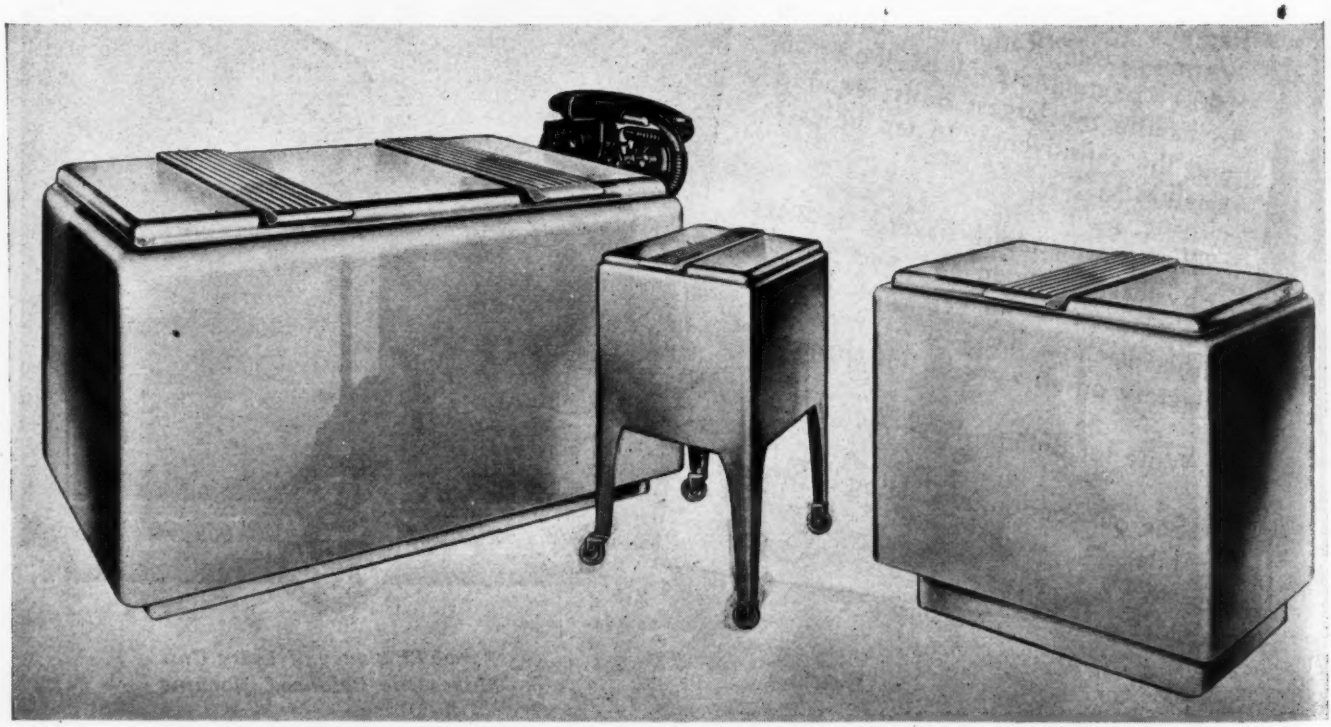


Noblewest Precision Marking Machine with Dial Feed

Noblewest High-Speed Marking Machine

A high-speed precision marking machine with dial feed, known as Noblewest Model G232, has been introduced on the market by the Noble & Westbrook Mfg. Co., Westbrook St., East Hartford 8, Conn. The machine is designed for the production marking of one or more lines of characters on the flat surfaces of small metal or plastic parts. The illustration shows the machine tooled for roller marking of molded Bakelite parts. The rolling method of marking is advantageous on brittle and thin-walled sections such as these, because only a small surface of the marking die comes in contact with the work. The marking pressure is adjustable, and is arranged with compensating spring to allow for variations in wall thickness.

The work-pieces are fed into stations on the carrier dial, which re-



Recently Developed Cleaning Systems Placed on the Market by the Gray-Mills Co.

To obtain additional information on equipment described on this page, see lower part of page 211-A.

volves continuously, carrying the work-pieces to the die. After being marked, the parts are automatically ejected. The dial has both vertical and horizontal adjustment, so that the inscription can be placed in any position on the work-pieces. A variable-speed drive is provided. The production varies from about 25 to 50 per minute, depending on the shape and size of the work-piece and the speed of the operator.

An automatic roll leaf attachment with ratchet feed is provided to apply color to the inscription in the same operation. The marking die is electrically heated, and a rheostat is furnished for uniform control. 87

Harvill Heavy-Duty Die-Casting Machines

The line of die-casting machines made by the H. L. Harvill Mfg. Co., P.O. Box 335-P, Los Angeles, Calif., has been supplemented by an HDW series of heavy-duty, high-capacity, cold-chamber type machines for die-casting copper-base alloys. An accessory conversion unit is available, consisting of a hot-chamber furnace and an injection attachment, to replace the cold-chamber injection mechanism, which adapts the machine for automatic, high-speed casting of zinc, tin, and lead alloys.

This series of machines is built in three sizes having normal die dimensions of 13 by 24, 15 by 28, and 21 by 30 inches. The horizontal die dimensions may be increased as much as 50 per cent when the arrangement of cavities permits. Cylinders can be provided for exerting pressures from 3400 to 11,800 pounds per square inch on the injected metal. The centrifugal pump is driven by a 15-H.P. motor. The pumping unit is under high load only when the machine is in operation, thus increasing the life of the pump and providing lower operating costs.

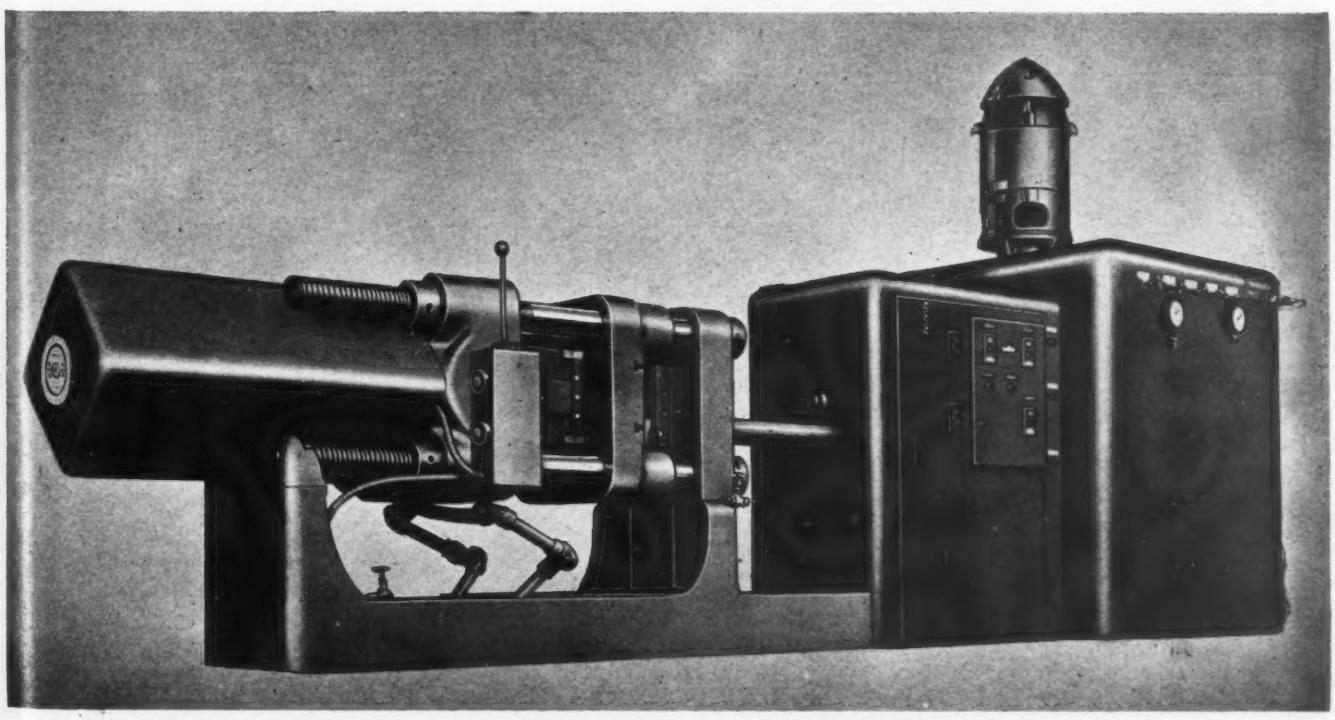
One hydraulic system can be used for any combination of machines whose total requirements are 400 cycles per hour or less. Water is employed as the hydraulic fluid to eliminate fire hazard. Cylinder speed may be varied over an infinite range, from extremely slow to instantaneous. The rate of opening and closing of the dies is also variable.....88

Searjeant "Counting-Guard" for Power Presses

The W. H. Searjeant Co., 89 Allen St., Rochester, N. Y., has brought out a new guard for power presses. It is of unusually simple design, and can be easily installed and quickly adjusted. Its operating principle is based on the sweep action of an adjustable guard arm actuated by the downward motion of the ram. The guard is so arranged that it will operate even if the ram link should break.

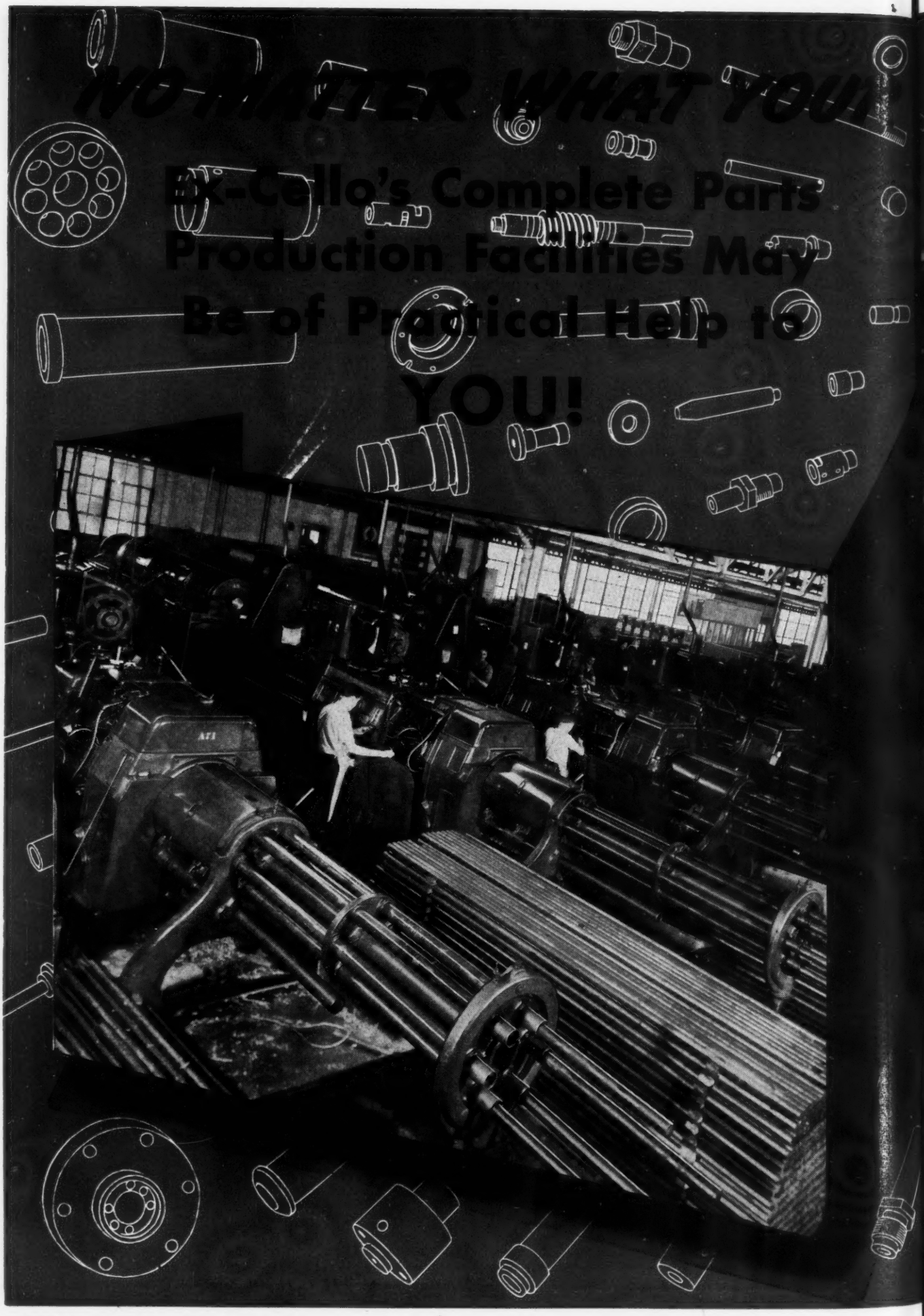
"Counting-Guard" which Protects Operator, and also Records Number of Pieces Produced

When the press is not in operation, the guard remains at the extreme left-hand position, out of the



Heavy-duty Hydraulic Die-casting Machine Made by H. L. Harvill Mfg. Co.

To obtain additional information on equipment described on this page, see lower part of page 211-A.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Few people realize how extensive are Ex-Cell-O's facilities for the speedy production of quality parts. Yet the same wide experience, the engineering "know-how", and the outstanding accuracy that distinguish Ex-Cell-O machine tools and cutting tools wherever they are used . . . in many parts of the world . . . go into Ex-Cell-O's production parts manufacture.

If your product requires carefully machined parts, the chances are Ex-Cell-O can work with you to your economical advantage. Contact Ex-Cell-O today, either at the Head Office in Detroit or through any one of the 27 other leading industrial centers where Ex-Cell-O field engineering representatives are located.

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way. As soon as the clutch is tripped, the guard sweeps completely beyond the press feed area on the first half of the downward stroke. Thus the operator's hands are brushed aside before the die closes.

An entirely new feature of this guard is the automatic counter which registers each stamping. This counter, from which the guard derives the name "Counting-Guard," is mounted on the cross-bar. Since most punch press work is handled on a piece-work basis, the automatic counter serves the double purpose of keeping the operator aware of his piece-work rate and making it necessary for him to keep the guard in its safeguarding position in order to register or count the number of pieces produced. Thus the employe is given an incentive for using the guard properly to protect himself from injury while the employer has an accurate record of the die stampings produced by each operator. An important feature of this guard is that the entire assembly can be quickly swung aside to permit access to the dies without the use of wrenches. 89

Three New Insert-Chaser Die-Heads

Three new die-heads have been developed recently by the Eastern Machine Screw Corporation, 23-43 Barclay St., New Haven 6, Conn. The Style DMT insert-chaser die-head, shown in Fig. 1, is for cutting taper pipe threads when mounted on Brown & Sharpe automatic machines. The head of this die opens gradually to form the taper, and it is said to eliminate marks along the thread such as are usually present when a "jam" cut is made.

Fig. 2 shows the Style SAM, and Fig. 3, the Style SMM, size No. 103.

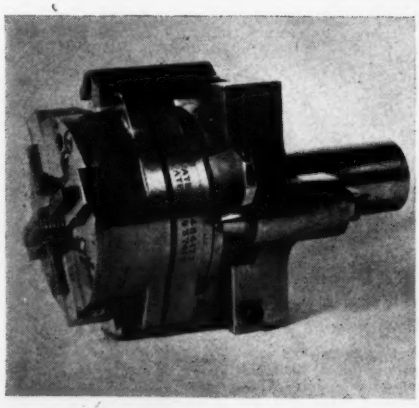

Fig. 1. Insert-chaser Die-head for Cutting Taper Pipe Threads

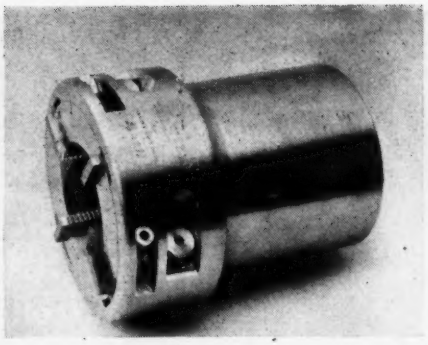

Fig. 2. Solid, Adjustable Die-head with Insert Chasers

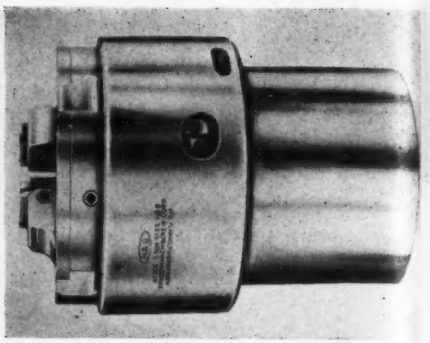

Fig. 3. Die-head that Permits Tapping while Threading

These two solid, adjustable die-heads with insert chasers were designed with shanks to fit over the spindle of Goss & DeLeeuw double threading chucking machines, thus permitting tapping while threading. The design of these heads resulted in a minimum amount of overhang. The Style SMM, No. 103, solid, adjustable head takes the same carriers as the No. 103 size of opening die-heads, and has a normal thread range up to 1 1/4 inches in diameter by 3 inches long. 90

Diamond Cup-Shaped Honing Wheel

The Precision Diamond Tool Co., 102 S. Grove Ave., Elgin, Ill., has placed on the market a metal-bonded diamond cup-wheel developed for diamond honing operations. The new cup-wheel is made in 3- and 4-inch diameters and 500 mesh for mounting on the inside of 6- or 7-inch diamond cup-wheels used on standard carbide-tool grinders.

After rough-grinding the tool on the large wheel, the operator can produce a fine cutting edge in a few seconds with one stroke across the smaller diamond honing wheel, using the same protractor set-up. This process eliminates the hand-honing and regrinding operations ordinarily required. 91

Micrometer with Dial Indicator

A micrometer equipped with a dial indicator has just been introduced to the trade by the Federal Products Corporation, 1144 Eddy St., Providence 1, R. I. This new type of micrometer is designed to combine the accuracy of the conventional micrometer over the full 1-inch range of its measuring screw with the precision of the dial indicator. It can be used as a dial indicator comparator without the necessity of setting to a master gage, the micrometer feature furnishing its own precision setting.

When used as a micrometer, the spindle is brought in contact with the work until the dial hand indicates zero. The measurement is then read on the barrel and thimble of the micrometer. Used as an indicating comparator, it can be set to the nearest thousandth of an inch, and the variation from that setting can then be read on the dial. In both cases, the anvil pressure is constant, and therefore permits the full accuracy of the instrument to be utilized.

The micrometer scale and the indicating dial have 0.0001 inch graduations, and the full measuring capacity range is from 0 to 1 inch. In using the instrument as a comparator, the measuring spindle is locked in the desired position by a new type of clamp which provides a uniform grip without affecting alignment accuracy. The opposite anvil is retracted by pressure on the finger or thumb button. This enables the work to be inserted with less chance of having its surface scratched by the anvils, and also prevents excessive

Federal Micrometer Equipped with Dial Indicator

To obtain additional information on equipment described on this page, see lower part of page 211-A.

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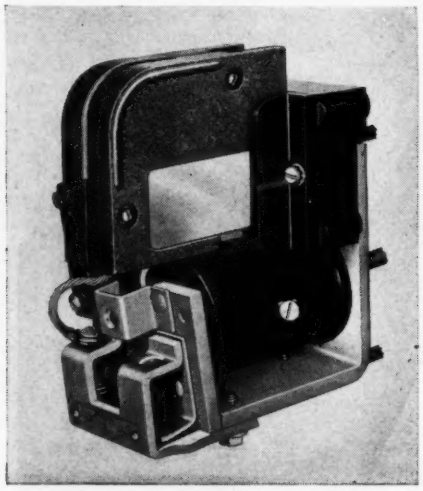
wear of the latter members. Both contact faces of the anvils are tungsten-tipped, and are lapped parallel within extremely accurate limits.—92

Westinghouse Magnetic Contactor

For limited space, severe-duty applications, the Westinghouse Electric Corporation, Pittsburgh 30, Pa., has brought out a Type M line of direct-current, single-pole, magnetic contactors. Compact in design, these contactors save panel space, and their unit construction speeds assembly and assures accurate alignment.



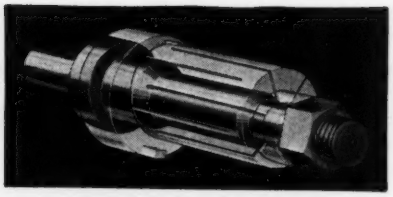
Westinghouse Single-pole Magnetic Contactor

The contactors are available in rear- or front-connected units, with small or deep frames.

Small-frame contactors are limited to voltages of 250 volts, while deep-frame contactors are suitable for voltages up to 600 volts. The operating coils are rated for continuous duty, and will operate the contactors at from 80 to 110 per cent of their rated voltage. The contacts are insulated for a potential difference between parts of 600 volts. ——93

Expanding Mandrel with Eccentric Sleeve

A precision expanding mandrel with an eccentric sleeve which will hold eccentric parts for grinding or machining within a tolerance of 0.0005 inch or less has been announced by Erickson Tools, Division of Erickson Steel Co., 2309 Hamilton Ave., Cleveland, Ohio. With this mandrel, eccentric parts can be turned or finished with the same tools and equipment as are used for concentric parts, thus reducing tool costs.



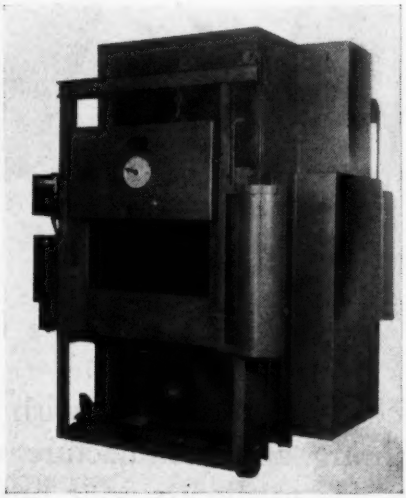
Erickson Mandrel with Expanding Eccentric Sleeve

Interchangeable sleeves which fit one shank are available for different diameters. The sleeve collapses the moment the nut shown in the phantom view is released. An advantage of the collapsing sleeve is that it will not injure highly finished internal surfaces, as sometimes happens when the work is forced on a solid mandrel. The expanding mandrel can be adapted for air or hydraulic operation. —— 94

Furnace for Preheating Magnesium Sheets

Production at the Consolidated Vultee Aircraft Corporation, Benbrook, Tex., required the preheating of magnesium sheets before forming. The furnace illustrated was designed and built by the Despatch Oven Co., 619 S. E. Eighth St., Minneapolis 14, Minn., for this purpose.

The furnace was made portable by mounting it on casters to permit moving it from one press brake to another. By positioning the furnace close to the press brake, temperature drop of the sheet in transferring it to the forming machine was minimized. Heat is introduced into the furnace from the top and bottom, with recirculating ducts on both side walls to insure uniformity of temperature within plus or minus 5 degrees F. A fan is provided to obtain over forty air changes per minute. There are vertical lift doors at each end of the furnace to permit rapid handling of the sheets. ——95



Despatch Portable Magnesium Sheet Preheating Furnace

McIntyre Light-Weight Rotary Pumps

A line of rotary, spur gear pumps, designated Series 100, has been announced by the McIntyre Co., 15 Riverdale Ave., Newton 58, Mass. This series of pumps will deliver from 1/2 gallon to 3 gallons per minute, at 1750 R.P.M., with pressures up to 1000 pounds per square inch.

Rotary Pump of Aluminum Construction Built by the McIntyre Co.

Over-all dimensions are 3 1/4 inches high, 2 1/4 inches wide, and 2 3/4 inches deep. The pumps are of aluminum construction with nitrided gears and shafts, and weigh only 1 3/4 pounds. Standard models are designed for direct motor, flexible-coupled drive, but pumps can readily be supplied for other types of drives and various mounting conditions. Power requirements at maximum pressure varies between 0.40 and 2.25 H.P. ——96

General Electric Arc-Welding Compound

An arc-welding compound designed to aid in instantaneously creating and maintaining a metallic welding arc where low currents and small-diameter electrodes are employed has

To obtain additional information on equipment described on this page, see lower part of page 211-A.

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Complete stocks of Standard Carboloy Cemented Carbides—a classification which will fill 60-80% of ALL your carbide tool needs—are available through Carboloy Company and leading mill supply distributors in 45 cities, coast-to-coast. Servicing the major production centers, this coverage brings *fast* deliveries on more than 300 sizes and styles of standards.

Now more than ever, you can get the RIGHT tool for the job at the RIGHT time with these *plus values:* increased production, improved finish, longer tool life, lowered machining costs and reduced tool inventory. For turning, boring or facing steels, other ferrous or non-ferrous metals or the non-metallics, these are the carbides to buy!

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Portland, Ore. . . J. E. Haseltine & Co.
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been announced by the Electric Welding Division of the General Electric Co., Schenectady 5, N. Y. This new compound, known as the "Strike-easy," is easily applied, and can be used on any kind of metal with any type of electrode. The compound is available in paste form, ready for use. 97

Cherry Rivets and Pneumatic-Hydraulic Rivet Gun

The conversion of blind riveting technique, used so extensively in military and commercial aircraft production and maintenance, to peacetime industries created new demands for blind rivets of larger size and rivet guns for their application. To meet these demands, the Cherry Rivet Co., 231 Winston St., Los Angeles 13, Calif., has brought out three new rivets having diameters of 7/32, 1/4, and 9/32 inch. These blind rivets are available in the three standard Cherry rivet types, namely, self-plugging, regular hollow, and pull-through designs which are supplied in modified brazier and 100-degree countersunk head styles. The rivets are made from A17S-T or 56S aluminum alloy, and are also available in steel.

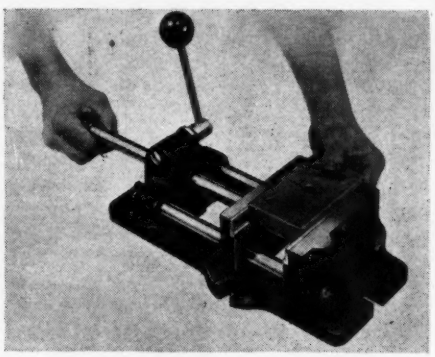
To install these larger rivets, a pneumatic-hydraulic Cherry rivet gun designated the G-40, which is applied as shown in the illustration, is now being manufactured. This riveting gun operates on from 75 to 90 pounds air-line pressure, is 13 inches high, and weighs 7 pounds. It is claimed that this gun is so well balanced that it can be easily applied by one hand in any position. 98

Pneumatic-hydraulic Rivet Gun Made by the Cherry Rivet Co.

Heinrich "Grip-Master" Vise

A quick-acting vise of novel design, known as the "Grip-Master," has been developed by the National Machine Tool Co., Racine, Wis. This new vise, instead of being equipped with the adjusting screw commonly employed in vises, has a movable jaw which can be quickly adjusted to the work and then locked securely by a slight pressure of the hand on a locking lever.

The bars and locking mechanism of the vise are hardened and precision ground. The unusually wide clearance between the jaw guides permits drilling through the work and prevents interference from accumulating chips. The jaws have built-in recessed parallels, and there is a removable V-jaw accessory which facilitates drilling round pieces. The vise is made in four jaw width sizes of 3, 4, 6, and 8 inches. 99

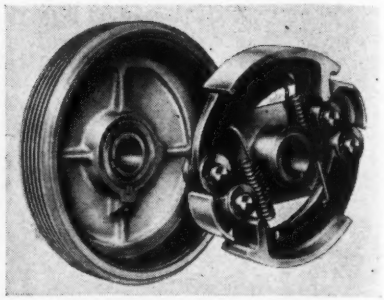


"Grip-Master" Vise

Salsbury Automatic Clutches

An automatic clutch has been developed by Salsbury Motors, Inc., 4464 District Blvd., Los Angeles 11, Calif., to eliminate sudden shock in starting machinery or power-driven equipment. This clutch can be installed on the shaft of any engine or electric motor. It applies power progressively by centrifugal action to the driven machine, engaging and disengaging the drive without manual control.

In the metal-working, machine tool, mill, and factory fields, it can be used in driving hoists, winches, blowers, fans, compressors, lathes, shapers, milling machines, jig borers, planers, spraying equipment, conveyor systems, tractors for towing plant trains, pumps, and testing equipment. Although a mechanical clutch, it provides smooth cushioned action, and permits complete disengagement while idling and positive engagement when driving, with no possibility of slippage.

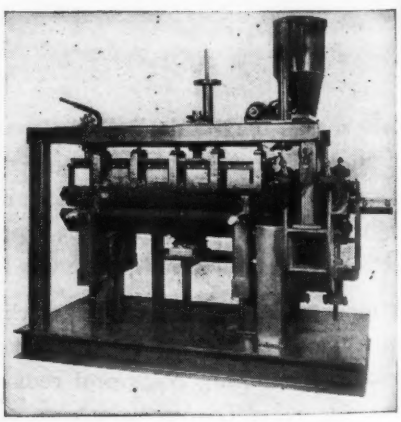


Centrifugally Operated Clutch Made by Salsbury Motors, Inc.

This clutch is available in two models—one with a range from the fractional-horsepower sizes up to 3 H.P., and one for drives up to 6 H.P. These clutches can be applied to V-belt, flat-belt, gear, sprocket, coupling, or variable-speed transmissions. The 3-H.P. model has a drum 5 1/4 inches in diameter and a length of 2 11/16 inches; the 6-H.P. model has a drum diameter of 7 1/4 inches and a length of 4 1/2 inches. 100

Berkeley Seam-Welders

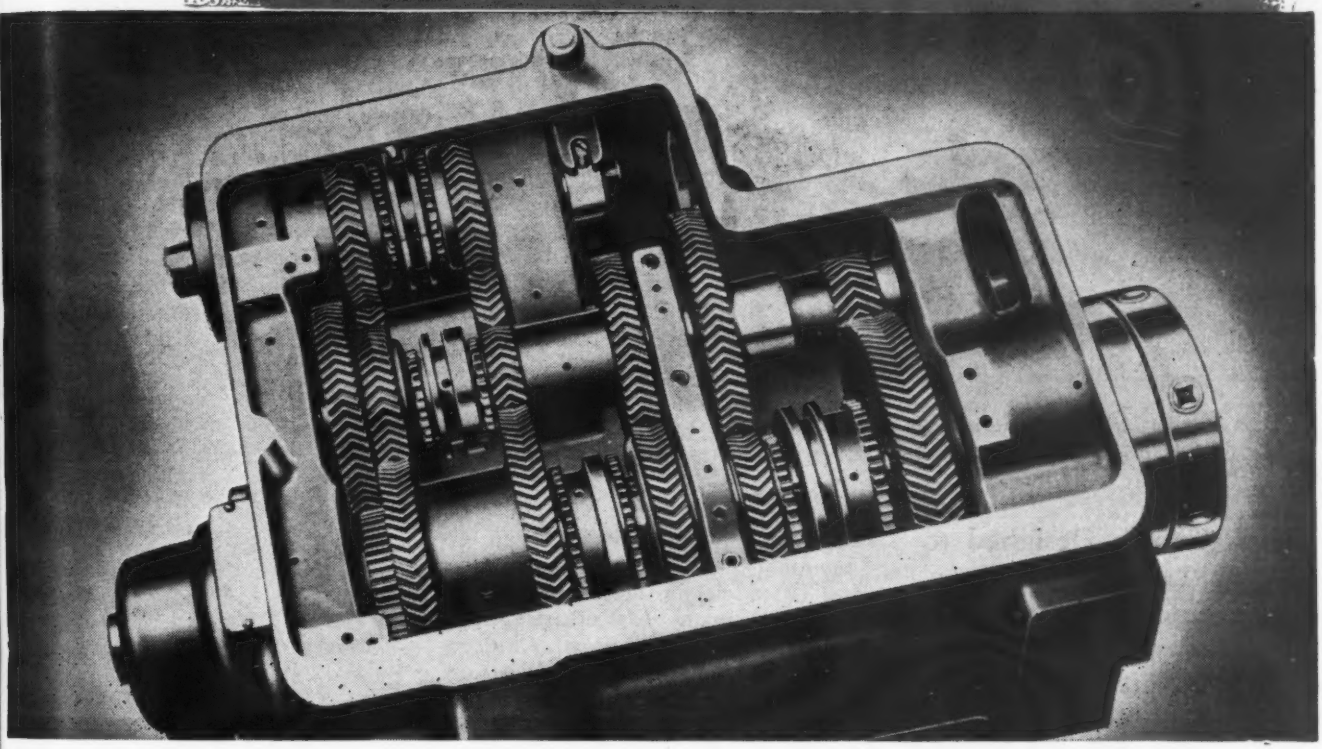
The Penn Tool & Machine Co., Danville, Ill., has brought out a new line of Berkeley welders designed for welding the longitudinal seams of preformed tubes in round, square, and various other shapes. The preformed tubes are simply fed into one end of the welding fixture and emerge at the opposite end with the seam welded. With this arrangement, one section follows another, the welding operation being continuous. The welding is accomplished by means of an automatic electric arc submerged in a granular flux. The



Berkeley Seam-welder Built by Penn Tool & Machine Co.

To obtain additional information on equipment described on this page, see lower part of page 211-A.

Pioneers OF THE CONTINUOUS TOOTH HERRINGBONE GEARED HEAD



SIDNEY *Precision* LATHES

● Sidney long ago experienced the "growing pains" essential to perfecting this smooth flowing power unit.

The superiority of the continuous tooth herringbone gear is well known and universally recognized.

This form of tooth provides more tooth contact—results in greater strength, smoother action and eliminates end thrusts through the opposed helix angle.

This herringbone geared head offers distinct advantages when carboloy tipped tools are used, since gears are constantly in mesh employing internal external gear tooth clutches thus holding backlash to a minimum—insuring greater tool life.

The SIDNEY MACHINE TOOL COMPANY

Builders of Precision Machinery

SIDNEY • OHIO

ESTABLISHED 1904

weld requires no finishing, is of uniform quality, and is produced at speeds of from 50 to 250 inches per minute, depending upon the metal thickness. Being completely automatic, the machines can be operated by unskilled labor.

The welders can be equipped with any one of several makes of electrical feeding mechanisms. These machines are regularly made in five sizes, ranging from 84 inches long, 54 inches wide, and 60 inches high up to 120 inches long, 96 inches wide by 108 inches high. Tubes from 4 to 21 inches in diameter can be handled on these machines. 101

Dust Goggle Made by American Optical Co.

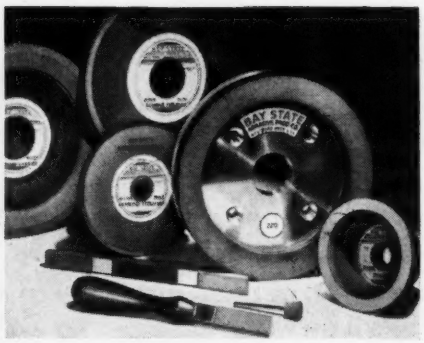
Dust Goggle Designed to Provide Greater Safety and Comfort

A dust goggle with an acetate eyecup that permits a wider angle of vision and provides greater comfort for the wearer has been placed on the market by the American Optical Co., Southbridge, Mass. A thin wire-mesh screen on the inside of each side shield provides protection against fine dust particles.

The eyecups are shaped to conform to the contour of the right and the left eye, and fit snugly against the face. The ventilating system covers a large area to reduce fogging. The lenses are of "AO Super Armorplate," and the retaining rings are of solid fiber. Rubber cushions are also available. 102

Diamonds in New Improved Vitrified Bond

A vitrified bond designed expressly for diamond abrasives has been brought out by the Bay State Abrasive Products Co., 21 Union St., Westboro, Mass., for use in grinding cemented-carbide tools and other extremely hard materials. This new vitrified bond supplements the company's line of resinoid-bonded diamond abrasives developed for precision and form grinding operations and the metal-bonded diamond abrasives used for off-hand grinding jobs. Long life, a high degree of accuracy, and low grinding cost per tool are advantages claimed for this new diamond abrasive, which is available in a wide range of standard shapes and sizes. 103

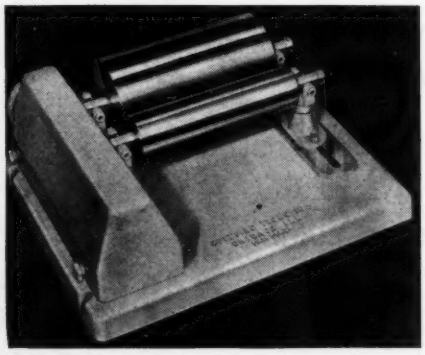


Bay State Diamond Abrasive Wheels and Stones

Spitfire Roller Lapping Machine

The lapping and polishing of round plugs, pins, or rods can be accomplished at a high production rate on a roller lapping machine now being made by Spitfire Tools, Inc., 2930 N. Pulaski Road, Chicago 41, Ill. As shown in the illustration, the machine consists of two ground rollers, 3 and 6 inches in diameter by 12 inches long, which both rotate in the same direction on self-aligning, adjustable bearings. The two rollers rotate at the same speed, and are adjustable to accommodate work up to 6 inches in diameter.

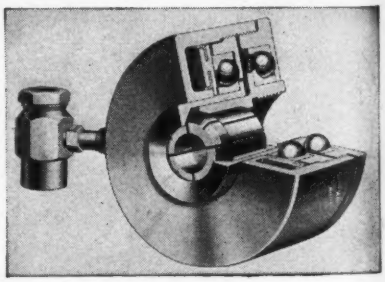
Abrasive compound is placed on the rollers and spread evenly over both surfaces. The work is held between the rollers by a notched fiber stick which is pressed down on the work and moved from side to side across the plug or pin. No chucks are required, and tapered plugs or plugs with shoulders can be handled. Cooling periods are usually unnecessary, because the excessive heat is dissipated by the large mass of the rollers. 104



Lapping Machine with Rotating Rolls Developed by Spitfire Tools

Erickson Collet Type Speed Chuck

Erickson Tools, Division of Erickson Steel Co., 2309 Hamilton Ave., Cleveland, Ohio, has just added to its line of precision collet chucks and expanding mandrels a new air-operated collet type speed chuck. Accurate clamping over the collapsing range of 1/32 inch makes it possible for this chuck to take the place of seven standard-size single-purpose collets. The precisely fitted matching angular surfaces of the chuck shank and collet provide a high degree of accuracy and great gripping power. The chuck is available in either foot-valve or hand-operated models, and is adaptable to any spindle. The Model 4AT chuck has a range of 1/8 to 1 inch, and the Model 6AT chuck has a range of 1 to 2 inches. Very little time is required for the maintenance or servicing of these chucks due to their simplified design. 105



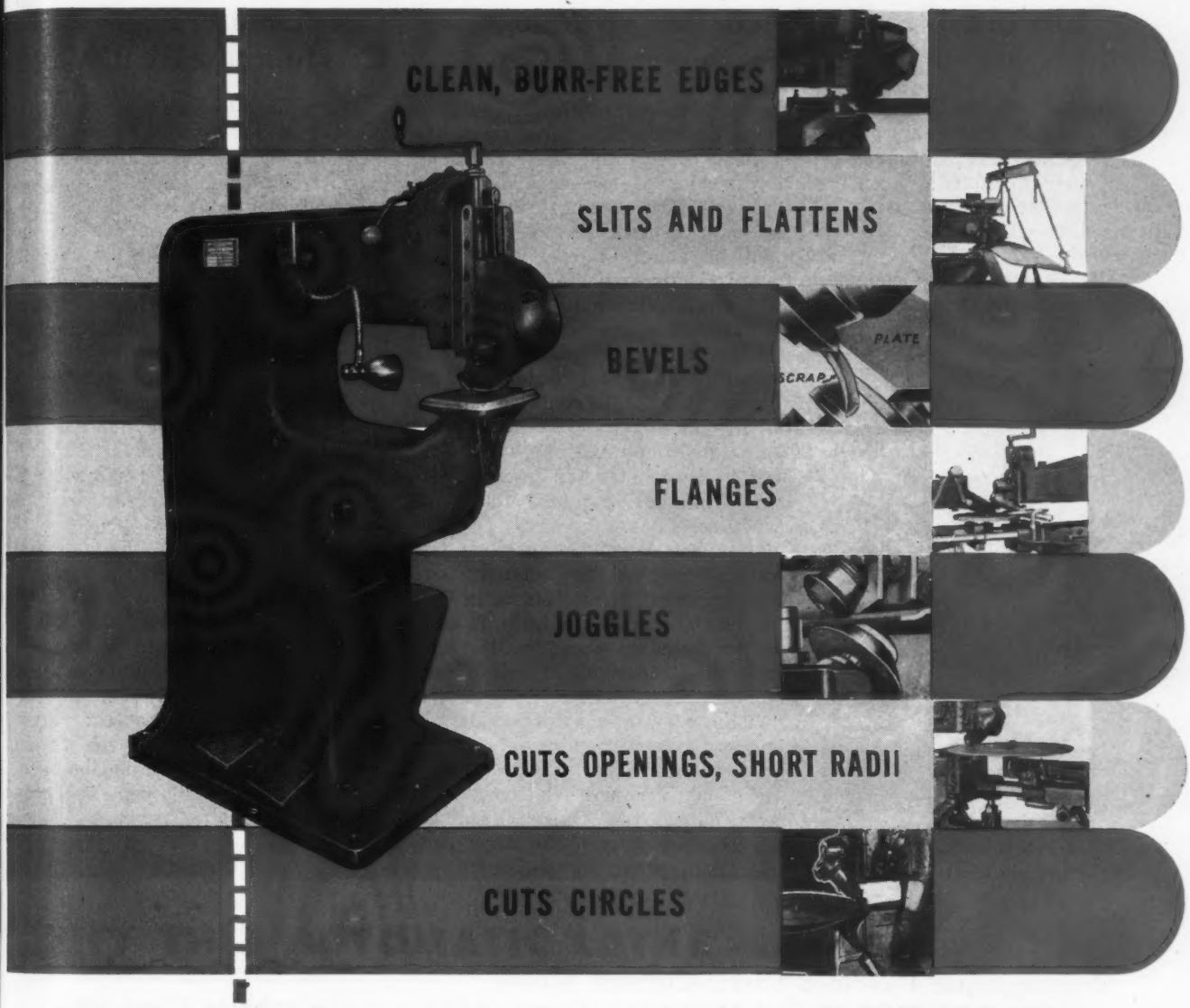
Erickson Air-operated Collet Type Speed Chuck

* * *

Fonda Gage-Blocks—Correction

In the description of the gage-blocks made by the Fonda Gage Co., 53 Daly St., Stamford, Conn., which was published on page 204 of the November, 1945, number of MACHINERY, it was mentioned that the gage-blocks are manufactured in sets of thirty-five, ranging in size from 0.001 inch to 4 inches. This should have read "ranging in size from 0.1001 inch to 4 inches."

To obtain additional information on equipment described on this page, see lower part of page 211-A.



THE SHEAR THAT DOES THE WORK OF 7 MACHINES— FAST, ACCURATELY, AT LOW COST

A Quickwork-Whiting rotary shear — cost-reducing equipment for any metal-working shop—does the work of plate-edge planer, punch shear, gap shear, bevel shear, rotary splitting shear, alligator shear, and flame cutter. By means of its special attachments a Quickwork bevels, flanges, slits and flattens, joggles, and cuts circles and openings at speeds up to 150 feet per minute.

Quickwork shears are available in capacities ranging from 16-gauge sheet to one-inch mild steel plate; write for information on the various models today. Ask for Bulletin QW-100.

WHITING
CORPORATION
15673 LATHROP AVENUE, HARVEY, ILLINOIS

Lincoln Electric Celebrates Fiftieth Anniversary

The Lincoln Electric Co., Cleveland, Ohio, is just fifty years old. It was in December, 1895, that John Cromwell Lincoln started the concern in downtown Cleveland with a capital of about $150. He is now chairman of the board.

Since its inception, the company has pioneered in the improvement of electric welding machines and processes. Nearly thirty-five years ago, the first direct- and alternating-current welder of the variable-voltage type was introduced. The company also was a pioneer in the development of general-purpose electrodes for producing machinable welds in mild steel. Other notable achievements are the automatic carbon arc process known as the "Electronic Tornado" and the "Shielded Arc" process. In 1928, in cooperation with the Austin Co., the Lincoln Electric Co. erected one of the first buildings ever to be constructed by arc welding. This building is a four-story structure.

John Cromwell Lincoln, Founder of the Lincoln Electric Co.

The growth of the organization has been marked, the company now having manufacturing plants in Canada, England, and Australia, in addition to the main plant in Cleveland. Under the leadership of John Cromwell Lincoln's younger brother, J. F. Lincoln, who is now president, the company has become widely known for its incentive system and its worker-management relations, which have enabled the Lincoln organization to avoid many of the labor problems facing other companies.

Only Greater Production Can Increase Real Wages

A few labor leaders seem to understand that real wages can only be increased as the result of increased productive efficiency. In "Organized Labor and Production," by Morris L. Cooke and Phillip Murray, we find this significant sentence: "In recent years, however, trade union leaders have realized that wages come out of the total production of the plant and that the way to get higher wages is to produce more goods."

Also, Edward T. Cheyfitz, national chairman of an important CIO division, writing in the December, 1944, issue of *Fortune*, ably supports the thesis that "in increasing our industrial efficiency lies the one sure way of raising America's and the world's living standard." Unfortunately, union leaders and union members very generally embrace a contrary philosophy and promote opposing practices. It becomes increasingly apparent that the future of organized labor and the future course of our country depend upon the outcome of "the race between education and catastrophe." — *Louis Ruthenburg*

* * *

Westinghouse Develops Direct-Current Motor with Wide Speed Variation

The ratio of maximum speed to slowest speed in a standard direct-current motor has heretofore been about 4 to 1. This has been true ever since the first direct-current motor was built a half century ago. Greater speed variations have required some extra feature, such as variable-voltage control, with attendant changes in horsepower output.

The Westinghouse Electric Corporation is now building four-pole direct-current motors that provide twice this previous speed range—about 8 to 1—with no change in rated output at any speed. Essentially, this is accomplished by separate control of two of the four field coils. Two adjacent poles are energized in the usual manner to supply a nearly constant magnetic flux. The remaining two poles are varied in strength by a special resistor from maximum to zero, and finally reversed. Thus, the combined field flux can be changed from a value representing the sum of all the fields to the smaller strength of their difference. Since the armature voltage does not change throughout this entire range, the horsepower output remains constant with variation in speed.

The wide-speed range motor is extremely useful on many machine tool applications where constant horsepower output is needed over wider and continuously adjustable ranges than have formerly been available from a 4-to-1 motor. Many of the gears previously required will be eliminated.

* * *

It is perhaps too little realized that the most valuable asset of an industrial enterprise is its people. Machines, buildings, equipment—all these can be duplicated. The one element that cannot be duplicated is the unique combination of talent, skill, and experience represented by the men and women of an organization, working together as a team.—*C. E. Wilson, President, General Motors*

Steel-Cutting Grades of Carbides Used for Machining Cast Iron

The use of a Carboloy steel-cutting grade of cemented carbide for machining castings containing a large amount of silicon sand is said to have doubled the production in one plant that had difficulty in machining castings of this kind.

The job consisted of rough-boring, finish-boring, back-facing, counterboring, and face-counterboring cast steel parts. Due mainly to numerous large deposits of extremely hard abrasive silicon sand encountered by the tools, the average production per eight-hour day was only from seven to eight pieces when using high-speed steel tools. By using Carboloy Grade 78B cemented carbide—the grade generally used for steel cutting—production rose to an average of sixteen to seventeen pieces in eight hours. Approximately ten parts were machined between grindings. The tools formerly employed produced on an average only two pieces per grind.

WHY THIS AUTOMATIC LATHE

is Faster

Peak production means pushing your speeds and feeds to the limits that tools or materials will withstand. And you can do that most precisely on this machine because *one* simple adjustment provides an infinite choice of feeds from .000″ to .058″. Such precise selection is never possible when you are limited by fixed ratios of pick-off change gears.

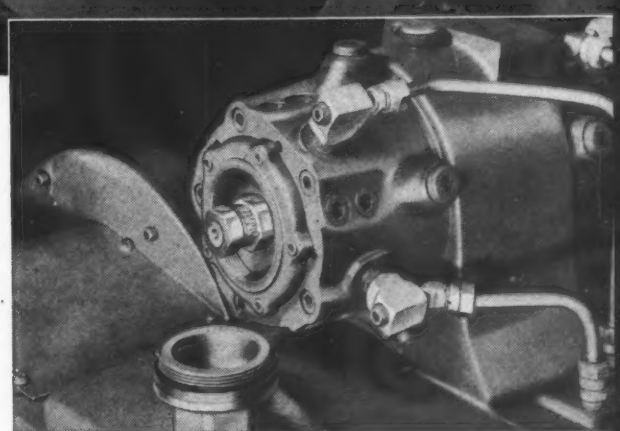
THE GISHOLT HYDRAULIC AUTOMATIC LATHE

This modern automatic lathe wastes no time in its swift operating cycle—on both machining and non-machining functions. It provides fast approach to work, fast retract at completion of cuts. And its productivity is further increased by the extreme rigidity that enables you to take multiple cuts smoothly and without vibration.

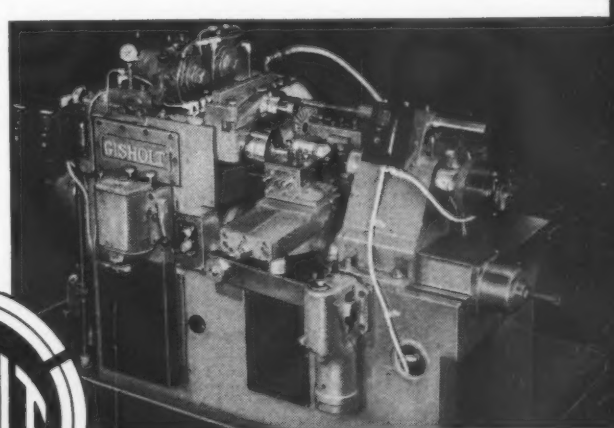
Set-up is faster, too, because there is no bother of re-arranging cams, feed gears, etc., and it is always easier to arrange tooling to best advantage. Write for full information.

GISHOLT MACHINE COMPANY
1209 *East Washington Ave. • Madison 3, Wisconsin*

Look Ahead : . . Keep Ahead : . : With Gisholt Improvements in Metal Turning



Independent feeds for front and rear slides can be regulated instantly by simple adjustment nuts on the ends of feed pump drive shaft.



The flexibility of this hydraulic system permits the addition of supplementary slides to bring more tools into play—to eliminate extra operations—to do more in less time.

New Trade Literature

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies Fill in on Form at Bottom of Page 211 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the January, 1946, Number of MACHINERY

Tool- and Die-Makers' Accessories

DIE SUPPLY CO., Department M, 5345 St. Clair Ave., Cleveland 14, Ohio. Catalogue 4 (40 pages), covering the company's complete line of accessories for tool- and die-makers and machine shops. Copies will be sent without charge if requested on a business letter-head addressed directly to the company.

Fasteners

MANUFACTURERS SCREW PRODUCTS, 209 W. Hubbard St., Chicago 10, Ill. Catalogue 15 (136 pages) covering the "Stronghold" complete line of fasteners. Copies will be sent without charge to those who specify or purchase fasteners if requested on a business letter-head.

Conveyors

ISLAND EQUIPMENT CORPORATION, 101 Park Ave., New York 17, N. Y. Bulletin FP-1, entitled "Spot Conveying by the New Improved Power-Flex Unit System." Copies available to those requesting them on a business letter-head.

Oil and Coolant Purifiers

DE LAVAL SEPARATOR CO., 165 Broadway, New York, N. Y. Series of bulletins on factory oil and coolant purifiers. Those interested in any particular type can obtain a copy of the bulletin by specifying it by the following numbers: FC-5, Cutting Oil Purifiers; FX-9, Chip Oil Extractors; FG-17, Grinding Coolant Clarifiers; FF-25, Factory Oil Purifiers; MB-1, Purifier Bowls; MP-5, Direct-Drive Centrifugal Oil Purifiers; MC-9, Construction Features of De Laval Purifiers; MU-1, De Laval Unimatic—a Complete Oil Purification Unit. 1

Print-Making Machines

OZALID DIVISION OF GENERAL ANILINE & FILM CORPORATION, Johnson City, N. Y. Circular entitled "Ozalid —The Newest Graphic Art," describing machines for making ten types of prints, including blue, black, redline, etc. Booklet showing examples of the types of prints made on Ozalid machines. 2

Precisionaire Inspection Equipment

SHEFFIELD CORPORATION, Dayton 1, Ohio. Bulletin 600-1-45, descriptive of the Sheffield universal Precisionaire, an all-purpose air-flow gage for checking internal and external dimensions to very close limits. 3

Foundry Equipment

AMERICAN FOUNDRY EQUIPMENT CO., 555 S. Byrkit St., Mishawaka, Ind. Catalogue entitled "The American Line," covering the company's entire line of products, including blast cleaning equipment, dust collectors, rod straighteners, and shear machines, etc. 4

Alloy Welding Chart

ARCOS CORPORATION, 1515 Locust St., Philadelphia 2, Pa. Wall chart containing data on high- and low-alloy welding electrodes, including corrosion and heat resistance, weld metal surfacing, chemical analysis of weld metal, welding current, etc. 5

Proportional Current Input Controller

BRISTOL CO., Waterbury 91, Conn. Bulletin PB1226, descriptive of a new electric type controller for electric furnaces, which combines a proportional current input controller and a recorder in one case. 6

Production Parts and Unit Assemblies

EX-CELL-O CORPORATION, 1200 Oakman Blvd., Detroit 6, Mich. Bulletin 36151, describing the company's facilities for manufacturing production parts and unit assemblies. 7

Turbines, Diesel Engines, Gears, and Heavy Machinery

JOSHUA HENDY IRON WORKS, Sunnyvale, Calif. Catalogue entitled "This is Hendy," containing a pictorial presentation of the history of the company and an outline of its plans for the future. 8

Universal Testing Machine

STEEL CITY TESTING LABORATORY, 8843 Livernois Ave., Detroit 4, Mich. Circular descriptive of a new universal hydraulically operated testing machine for making tensile, transverse, and compression tests up to 60,000 pounds. 9

Miniature Ball Bearings

LANDIS & GYR, INC., 104 Fifth Ave., New York 11, N. Y. Catalogue 5, on R.M.B. miniature ball bearings, with outside diameters ranging down to 1.1 millimeter (0.043 inch). Some 200 types and sizes are available. 10

Hydraulic Pullers

WILLIAM S. PINE, 1635-39 E. 22nd St., Los Angeles 11, Calif. Catalogue illustrating and describing Jenny center-hole hydraulic pullers for pushing, pulling, and lifting service in industrial plants. 11

Arc-Welding Electrodes

WILSON WELDER & METALS CO., 60 E. 42nd St., New York 17, N. Y. Catalogue (32 pages) entitled "Arc-

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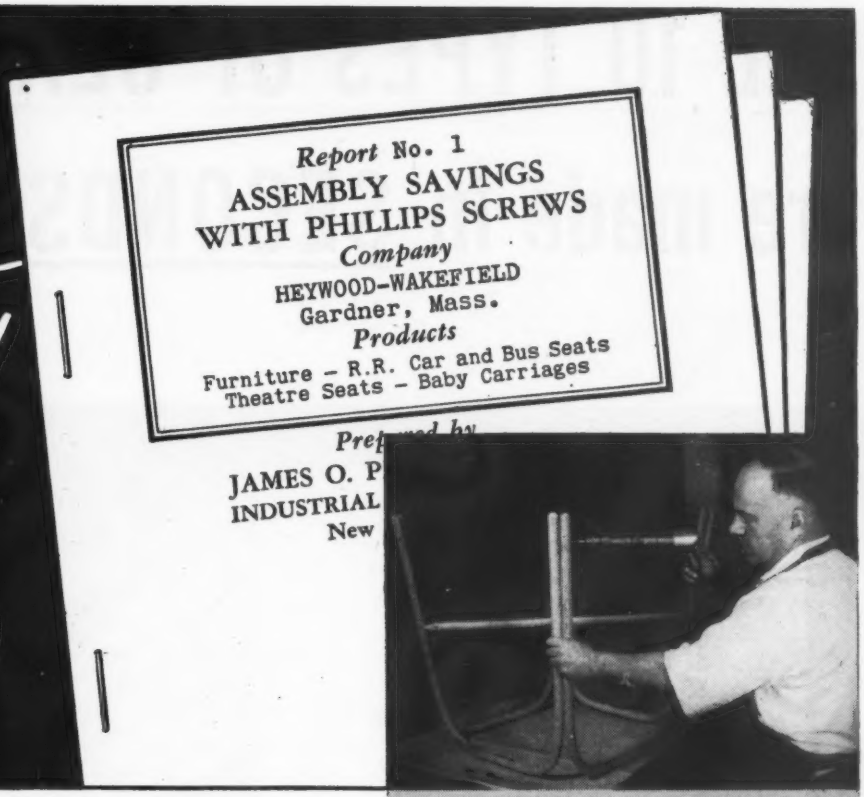
Inside on Assembly Savings

FROM THESE

FACT-JAMMED REPORTS!



AN INDEPENDENT SURVEY! AUTHENTIC! UNBIASED!

This investigator from the James O. Peck Co., industrial research authorities, is visiting leading American plants to get unbiased facts on assembly savings. His reports are available to you.

HEYWOOD-WAKEFIELD, like countless other successful manufacturers, use Phillips Screws for one good reason . . . *to cut costs.* When they discarded slotted screws and specified "nothing but Phillips" (with production savings up to 50%) they pointed up a lesson you can't afford to ignore with today's squeeze on profits!

The report on Heywood-Wakefield – and others now completed – are so revealing we are not waiting to publish them in a completed volume as originally planned. They will be distributed NOW – flash news of *current* economies you can make – AS THEY COME OFF THE PRESS!

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LEARN HOW YOU CAN CUT YOUR ASSEMBLY COSTS!

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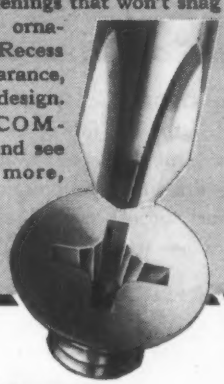
FIND OUT HOW HEYWOOD-WAKEFIELD CO. SAVES UP TO 50%

in assembling furniture, car and bus seats, baby carriages. . . . . .

By avoiding driver skids, parts spoilage, and delay required to demount and replace them . . . by driving screws faster at awkward angles that meant burred and broken screw heads with slotted screws . . . by eliminating pilot holes . . . by using fewer and smaller screws without sacrifice of holding power . . . by using power in place of hand drivers.

SALES BENEFITS, too, in lastingly rigid, burr-free fastenings that won't snag clothing . . . in the ornamental Phillips Recess that improves appearance, permits simplified design.

GET THE COMPLETE STORY and see why, more and more, Phillips Screws spot the profit-planned product!



PHILLIPS *Recessed Head* SCREWS

Wood Screws • Machine Screws • Self-tapping Screws • Stove Bolts

28 SOURCES

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Atlantic Screw Works
Atlas Bolt & Screw Co
The Bristol Co.
Central Screw Co.
Chandler Products Corp.
Continental Screw Co.
Corbin Screw Corp.
Elco Tool & Screw Corp.
General Screw Mfg. Co.
The H. M. Harper Co.
International Screw Co.
Lamson & Sessions Co.
Manufacturers Screw Products
Milford Rivet and Machine Co.
National Lock Co.
National Screw & Mfg. Co.
New England Screw Co.
Parker-Kalon Corp.
Pawtucket Screw Co.
Pheoll Manufacturing Co.
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Russell Burdsall & Ward Bolt & Nut Co.
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PHILLIPS SCREW MFRS.,
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Please send me the reports on Assembly Savings with Phillips Screws.

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Company.....

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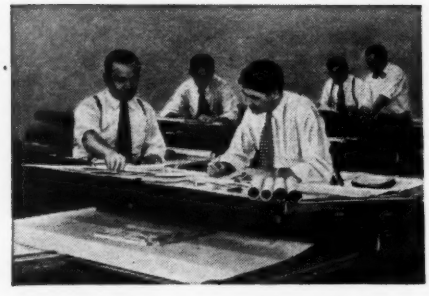
.....

ALL 10 TYPES OF OZALID PRINTS are made in SECONDS!



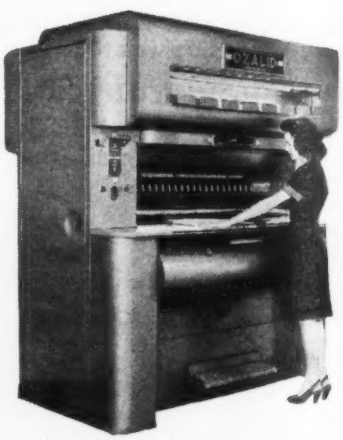
YOU ORDER the type of Ozalid print best suited for the job at hand . . . whenever you want a reproduction of an engineering drawing, specification sheet, typed report, or other original. Each type of print has its advantages!

YOUR PRINT is made in seconds—no matter what your choice. For all OZALID prints are produced in the same manner—Exposed and Dry Developed—that's all. *And,* no stopping when you change from one type of print production to another.

EACH PRINT is a positive—not a negative—reproduction of the original. Easier to read and check! Identifying colors may be assigned to prints of different departments...and prints made on paper, cloth, foil, or film to suit job conditions. Ozalid Chartfilm, for example, is oilproof, waterproof. Can be cleaned with a damp rag.

ROUTINE WITH OZALID—impossible with any other printmaking process: 1. Continuous tone prints of photographic subjects; 2. Transparent film prints which can be overlaid to show separate details; 3. "Intermediate" prints which simplify design changes; 4. Ten types of prints instead of 1, which save time, labor, and materials.

See all 10 types of Ozalid prints . . . and learn complete story. Write for free catalogue No. 29.



OZALID

DIVISION OF GENERAL ANILINE & FILM CORPORATION
JOHNSON CITY, NEW YORK

Ozalid in Canada—Hughes-Owens Co., Ltd., Montreal

Welding Electrodes," containing data designed to aid users in selecting the right electrode for any job. 12

Laminated Plastics

BAKELITE CORPORATION, UNIT OF UNION CARBIDE AND CARBON CORPORATION, 30 E. 42nd St., New York 17, N. Y. Booklet describing Bakelite laminating varnishes and laminated plastic products. 13

Gear Checking Machines

MICHIGAN TOOL CO., 7171 E. McNichols Road, Detroit 12, Mich. Technical bulletin 1124-45, descriptive of the improved sine-line involute checkers for spur and helical gears. 14

Shielded-Arc Phosphor-Bronze Electrode

AMPCO METAL, INC., 1745 S. 38th St., Milwaukee 4, Wis. Bulletin W-7, describing "Phos-Trode," a shielded-arc phosphor-bronze welding electrode. 15

"Dot-Weld" Equipment

METALLIZING CO. OF AMERICA, 1330 W. Congress St., Chicago 7, Ill. Bulletin D-1-A, entitled "Reclaim Defective Castings and Eliminate Residual Stress with the New Dot-Weld Process." 16

Welding Electrode Chart

PAGE STEEL & WIRE DIVISION, AMERICAN CHAIN & CABLE CO., INC., Bridgeport 2, Conn. Wall chart DH-1314, listing the chemical and physical properties of Page welding electrodes and gas welding rods. 17

Powdered Metal Friction Materials

GENERAL METALS POWDER CO., 130 Elinor Ave., Akron 5, Ohio. Folder describing the use of Gempco powdered metal friction materials in clutch and brake design. 18

Variable-Speed Buffing and Polishing Machines

STANDARD ELECTRICAL TOOL CO., 2500 River Road, Cincinnati 4, Ohio. Bulletin B2, describing infinitely variable-speed buffing and polishing machines. 19

Arc-Welding Machines

AIR REDUCTION, 60 E. 42nd St., New York 17, N. Y. Booklet illustrating and describing the Wilson "Bumblebee" improved alternating-current arc-welding machines. 20

Man-Au-Trol Vertical Turret Lathes

BULLARD CO., Bridgeport 2, Conn. Catalogue containing a complete description of the new line of Man-Au-Trol vertical turret lathes. 21

Cushioned Tool Bits

GENERAL TOOL & DIE CO., INC., 555 Prospect St., East Orange, N. J. Circular descriptive of 12 per cent cobalt high-speed steel tool bits provided with a copper cushion. 22

Grinding-Wheel Dressers and Cutters

DESMOND-STEPHAN MFG. CO., Urbana, Ohio. Catalogue 45, covering the Desmond complete line of grinding-wheel dressers and cutters. 23

Steelweld Presses

CLEVELAND CRANE & ENGINEERING CO., 1129 E. 283rd St., Wickliffe, Ohio. Catalogue 2010-B, describing Cleveland Steelweld bending presses and bulldozers. 24

Hydraulic Presses

HYDRAULIC PRESS MFG. CO., Mount Gilead, Ohio. Bulletin 4500 (88 pages), descriptive of the H-P-M all-hydraulic presses for modern pressure processing. 25

Sintered-Carbide Dies

FIRTH-STERLING STEEL CO., McKeesport, Pa. Folder describing a case history that demonstrates the long life of Diecarb blanking and forming dies. 26

Turbine Pumps

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J. Bulletin H-450-B33, showing typical applications of Worthington vertical turbine pumps. 27

Collets and Feed-Fingers

SUTTON TOOL CO., Sturgis, Mich. Booklet on Sutton diamond-serrated collets and feed-fingers for automatic and hand screw machines. 28

To Obtain Copies of New Trade Literature

listed on pages 210-B, 211 and 211-A (without charge or obligation), fill in below the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail within three months of the date of this issue to:

MACHINERY, 148 Lafayette St., New York 13, N. Y.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Name ..... *Position or Title* .....

[This service is for those in charge of shop and engineering work in manufacturing plants.]

Firm .....

Business Address .....

City ..... *State* .....

[SEE OTHER SIDE]

Five-Spindle Automatics

WARNER & SWASEY CO., Cleveland, Ohio. Circular 4504, illustrating and describing the new Warner & Swasey five-spindle automatic bar machines, built in two sizes. 29

Pneumatic Die-Cushion Data

DAYTON ROGERS MFG. CO., 2835 Twelfth Ave., S., Minneapolis 7, Minn. Data for figuring the size and capacity of pneumatic die cushions for inclinable presses. 30

Turret Punch Press

WIEDEMANN MACHINE CO., 1807 Sedgley Ave., Philadelphia 32, Pa. Bulletin 51, describing the Wiedemann R-5 turret punch press for short-run piercing. 31

"Flexigrip" Tubing Fittings

GUSTIN-BACON MFG. CO., Kansas City, Mo. Bulletin on the new "Flexigrip" tubing fittings which eliminate end preparation or soldering of the tubing. 32

Extruded Tenite Sheeting

TENNESSEE EASTMAN CORPORATION, SUBSIDIARY OF EASTMAN KODAK CO., Kingsport, Tenn. Booklet entitled "Forming Articles from Extruded Tenite Sheeting." 33

Coolant Pumps

ATLAS PRESS CO., 1253 N. Pitcher St., Kalamazoo 13D, Mich. Circular announcing new low prices on Atlas coolant pumps. 34

Hydraulic Units

JOHN S. BARNES CORPORATION, 301 S. Water St., Rockford, Ill. Bulletin 302-U, giving complete specifications on the new Barnes self-contained L-type hydraulic units. 35

Thermo-Couple Data Book

WHEELCO INSTRUMENTS CO., Chicago 7, Ill. Bulletin S2-6, containing information on the selection of the proper thermo-couples, as well as installation aids. 36

Coolant Filter

CUNO ENGINEERING CORPORATION, 133 S. Vine St., Meriden, Conn. Bulletin 3110, on the Cuno "Coolant-Klean" filter, designed especially for grinder coolants. 37

Arc-Welders

MID-STATES EQUIPMENT CORPORATION, 2429 S. Michigan Ave., Chicago 16, Ill. Folder illustrating and describing "Metal Zipper" arc-welders. 38

Synthetic Rubber Products

B. F. GOODRICH CO., 490 S. Main St., Akron, Ohio. Guide book for designers covering a wide range of synthetic rubber products suitable for industrial use. 39

Hydraulic Elevating Tables

LYON - RAYMOND CORPORATION, 2502 Madison St., Greene, N. Y. Bulletin 141, on Lyon-Raymond portable hydraulic elevating tables. 40

Tool Steel

CRUCIBLE STEEL CO. OF AMERICA, 405 Lexington Ave., New York 17, N. Y. Pamphlet entitled "Tool Steel for the Non-Metallurgist." 41

Riveting Machines

H. P. TOWNSEND MFG. CO., Hartford 1, Conn. Bulletin illustrating and describing this company's line of riveting machines. 42

Thread Gages

LOCKE GAGE CO., 10232 Woodward Ave., Detroit 2, Mich. Catalogue on thread plug and ring gages. 43

* * *

Carbide Inserts Lengthen Life of Wire Nippers

Carbide wear-protected nippers have been in constant daily use since 1939, cutting music wire springs from 0.004 to 1/16 inch diameter, at the plant of the Underwood Corporation, Bridgeport, Conn., without sharpening or resetting to compensate for wear.

To produce this long life, four Carboloy cemented-carbide inserts were set into the jaws of the nippers. One insert was placed on each side of a steel middle section of both the upper and lower jaws. The steel sections project beyond the inserts, so that when the jaws are closed there is a clearance of approximately 0.0015 inch between opposite inserts. Thus the carbide cutters never actually touch one another in operation.

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described on pages 193 to 209-C is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in January, 1946, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on other side of this blank.

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on pages 190-191, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning name of material as described in January, 1946, MACHINERY.

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Detach and mail to MACHINERY, 148 Lafayette St., New York 13, N. Y.

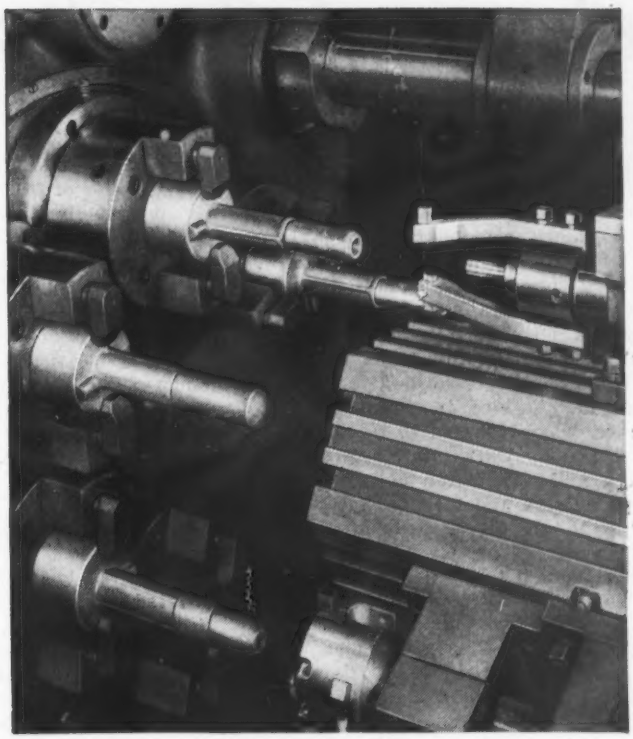
[SEE OTHER SIDE]

LEADERSHIP
PROVED BY HUNDREDS OF CASE HISTORIES

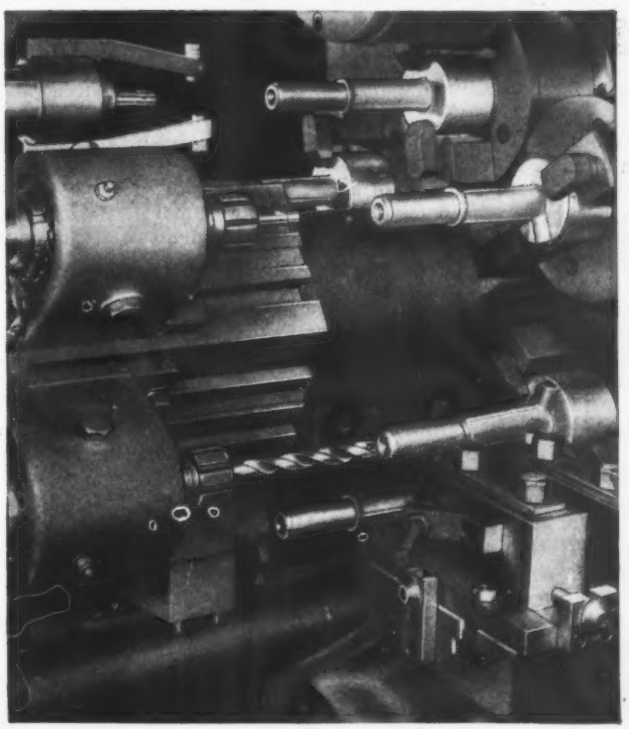
Cast Iron Distributor Base, now machined on New Britains by one of America's leading automotive manufacturers.

In order to speed production the manufacturer sought a method of doing this job on a multiple spindle chucking machine. The difficulty presented was the necessity for maintaining the required concentricity of the hole (±.005) between the bowl and shank ends. Because of the thin wall at the bowl end and the long 9-3/16" shank the drilling operation was made extremely difficult by the weave in the shank as it was turned. New Britain engineers developed the answer, with the use of special hydraulically operated hook bolt fixtures and drill guide on a New Britain Model 675 chucking machine.

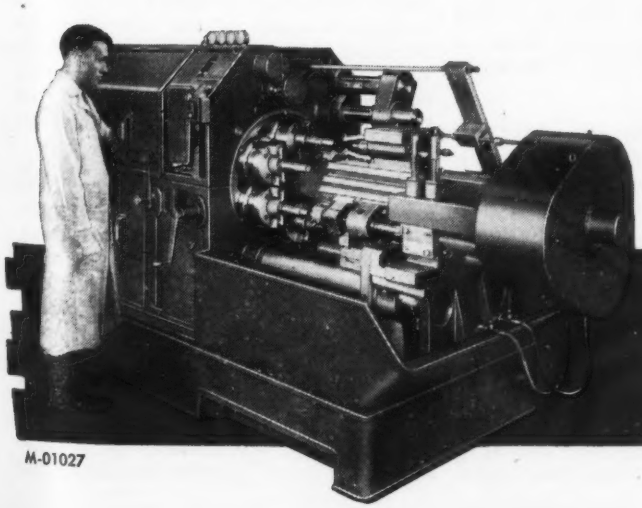
Production was stepped up six times over that of the lathes formerly used. The operation is performed in 19.4 seconds, or 186 pieces per hour, and with concentricity well within the manufacturer's requirements. Here is another typical example of how the versatility of New Britain Automatics and New Britain engineering has applied the economy of multiple spindle automatic production to a job which formerly limited the manufacturer to slower, more costly methods.



ENTIRELY OPEN END CONSTRUCTION... LOADING POSITION EASILY ACCESSIBLE



REAR VIEW: NOTE ACCESSIBILITY OF ALL TOOLS



M-01027

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN, CONNECTICUT
NEW BRITAIN-GRIDLEY MACHINE DIVISION

News of the Industry

California

DR. WILLIAM FREDERICK DURAND, professor emeritus of mechanical engineering, Stanford University, Calif., was awarded the A.S.M.E. Medal, the highest honor of the American Society of Mechanical Engineers, at the recent annual meeting of the Society in New York City. This award, given for distinguished service in engineering and science, was presented in recognition of Dr. Durand's work "in forwarding the design and application of principles of jet propulsion and for his effective leadership in the division of engineering and industrial research, National Research Council," of which he is a former chairman.

AXELSON MFG. CO., Los Angeles, Calif., is reorganizing its Gage Division to meet the growing demands of reconversion. The gage-making facilities of the MERCO GAGE CO. have been purchased and merged with those of the company. With its new facilities, the Axelson gage line will cover all standard thread plug and ring gages; tool-joint ring and plug gages; API tubing gages; blank rings and plugs; Acme thread rings and plugs; and special thread gages and taps.

FRANK W. JONES, formerly lieutenant commander, serving with Air Group 20 on the carriers *Enterprise* and *Lexington*, has been named head of the Light Metal Products Division of Northrop Aircraft, Inc., Hawthorne, Calif.

ALLEN-BRADLEY CO., Milwaukee, Wis., announces the appointment of the CAMPBELL & GEORGE CO., 379 Brannon St., San Francisco 7, Calif., as representative for the Allen-Bradley line of electric controls in northern California.

HENRY E. GUERIN, for the last five years plant manager of the Santa Monica, Calif., factory of the Douglas Aircraft Co., is retiring on January 1 after twenty-five years with the company.

Illinois, Indiana, and Missouri

HOEFER MFG. CO., 213-223 S. Chicago Ave., Freeport, Ill., has been sold to the OLIVER MACHINE TOOL CO., of Chicago, Ill. The firm name of the company will be retained and the manufacture of machine tools will be continued at the Freeport plant. GRINNELL F. OLIVER will serve as president, PAUL ANDREE as vice-president and general manager, and R. E. DREYER will be in charge of the engineering department. Mr. Andree has been with the Hoefer Mfg. Co. for the last twenty years, and Mr. Dreyer has been in charge of the drafting-room of the Hoefer plant for twenty years.

E. J. SANNE has been appointed manager of sales of the tin plate and export division of the Inland Steel Co., Chicago 3, Ill., succeeding FRANK R. MEYER, JR., vice-president, who is retiring. Mr. Sanne was employed by Joseph T. Ryerson & Son, Inc.—an Inland subsidiary—in 1917. He has served in the Ryerson service and sales divisions and as Inland's St. Paul district sales manager and assistant manager of sales of the sheet and strip division. Mr. Meyer has been connected with the company since 1911.

CLYDE W. BLAKESLEE has retired as general manager of N. A. Strand & Co., Chicago, Ill., but will continue to be associated with the company in an advisory capacity. Mr. Blakeslee has been connected with the company in the capacities of general sales manager and general manager for the last twenty-five years, and now wishes to be relieved of his responsibilities. WILBURN H. SWANSON succeeds Mr. Blakeslee as general manager.

RAYMOND T. O'KEEFE, JR., has been elected vice-president of the Kropp Forge Co., Chicago, Ill. He has been connected with the company since 1942, and formerly held the post of director of industrial relations. During the war he served as chairman of the Labor-Management Committee.

A. M. SASGEN has been elected president and treasurer of the Grand Specialties Co., Chicago 22, Ill. Mr. Sasgen succeeds his father, the late Michael J. Sasgen. He has served for many years as vice-president and general manager of the company.

R. R. BAUMAN has been appointed Chicago sales representative for the AJAX FLEXIBLE COUPLING CO., INC., Westfield, N. Y. He will be located at 407 S. Dearborn St., Chicago.

PRECISION EQUIPMENT CO., 32 N. State St., Chicago, Ill., has been appointed distributor for the REPUBLIC DRILL & TOOL CO. and the LYON METAL PRODUCTS CO.

ADRIAN L. POTTER, who since 1942 has been executive secretary of the American Society of Tool Engineers, Detroit, Mich., has been appointed staff head of the New England division of the National Patent Council, with headquarters at 578 Broadway, Gary, Ind.

FORREST G. WILSON, formerly a salesman at the Dallas, Tex., branch of the Wagner Electric Corporation, 6400 Plymouth Ave., St. Louis 14, Mo., has been appointed manager of the Indianapolis branch. H. F. ZAHN, formerly manager of the Atlanta branch, has been made manager of the Philadelphia branch. C. G. JACKSON, manager of the Boston branch, has been moved to Atlanta to succeed Mr. Zahn as manager of that branch. J. K. MILLER, previously a New York branch salesman, has taken over the management of the Boston branch.

Michigan

HARRY E. CONRAD has been appointed executive secretary of the American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit, Mich. Mr. Conrad

Harry E. Conrad, Newly Appointed Executive Secretary of American Society of Tool Engineers

spent eleven years in the employ of General Motors Corporation, his last post being district manager of Pontiac's Buffalo Division. Later, he was actively engaged as a partner in a firm extending the benefits of scientific management to small industrial groups. In 1942, he became manager of the War Products Division of the Automotive Council for War Production, and later was appointed manager of the Central Aircraft Council. He directed this organization until the cessation of hostilities.

SIDNEY OLDBERG has been appointed executive engineer of the Eaton Mfg. Co., Wilcox-Rich Division, 9771 French Road, Detroit, Mich. For ten years previously, Mr. Oldberg was with the Chrysler Corporation, recently having had charge of aircraft-engine research and development. CARL VOORHIES has been placed in charge of the division's new product development projects.

MARQUETTE MACHINERY CO., 15000 Charlevoix Ave., Detroit 30, Mich., has

SPEEDS-UP ROUGHING AND FINISHING

SUNOCO EMULSIFYING CUTTING OIL...

Specified for cutting high-carbon steel castings with Stellite Tools

Production-engineers are keen judges of the performance of modern cutting-lubricants. Shown above is a case where the engineers picked Sunoco Emulsifying Cutting Oil to help speed-up roughing and finishing of high-carbon steel castings.

Operation:	Roughing and finishing 8½" wheel-hub
Machine:	Gisholt 2L production turret-lathe
Material:	High-carbon steel casting
Feed:	.017" roughing; .009" finishing
Spindle Speed:	29 R.P.M.
Surface Cutting-Speed:	64.5 feet per minute
Type of Tool:	Stellite
Cutting Lubricant:	1 part Sunoco to 20 parts water

This case is just one of thousands in which experienced production-engineers have picked Sunoco for heavy cuts at high speed . . . long tool-life with minimum time-out for regrinding and resetting . . . high finish and close tolerances.

Sunoco is recommended by leading manufacturers and users of machine-tools for a wide variety of cutting-operations . . . on lathes, drill-presses, boring-machines, milling-machines, hobbers, and grinders.

Consult the Sun Cutting Oil Engineer near you for complete facts on Sun metal-working products. His services are yours to use to help you increase production and cut costs.

SUN OIL COMPANY • ***Philadelphia 3, Pa.***

Sponsors of the Sunoco News-Voice of the Air—Lowell Thomas

SECRETS OF PETROLEUM SCIENCE REVEALED

At Booth E-605, National Metal Congress, February 4th to 8th. Complete exhibit of making of petroleum products—producing, refining, transportation, and industrial application. Don't miss it!

SUN INDUSTRIAL PRODUCTS

OILS FOR AMERICAN INDUSTRY

been organized by WALTER HANNAUM and I. GRUSKIN. The company will deal in used metal-working machinery and will also engage in appraisal work and liquidation of entire plants or single machines. Both Mr. Hannaum and Mr. Gruskin were formerly with the Prussian Machinery Co.

TAFT-PEIRCE MFG. CO., Woonsocket, R. I., has appointed the BURLEIGH-STOCKER MACHINERY CO., 1914 Fisher Bldg., Detroit, Mich., agent for the Taft-Peirce line of small tools, gages, magnetic chucks, and machine tools in the eastern Michigan territory.

STANLEY J. ROBERTS CO., 5-259 General Motors Bldg., Detroit 2, Mich., has been appointed engineering sales representative in the Detroit territory for the KROPP FORGE CO., Chicago, Ill.

New England

R. LOUIS TOWNE has been appointed director of sales of the McIntyre Co., Newton 58, Mass., manufacturer of precision pumps and hydraulic motors. S. M. TREMAN has been appointed sales engineer, and R. F. KEMPER advertising and sales promotion manager. Mr. Towne was formerly sales promotion manager and director of sales of the Aircraft Division of the Surface Combustion Corporation, Toledo, Ohio; Mr. Treman previously served as chief engineer of the White Airplane Co., Buffalo, N. Y.; and Mr. Kemper was formerly district manager of the Surface Combustion Corporation.

DR. SANFORD A. MOSS, consulting engineer with the General Electric Co., West Lynn, Mass., was awarded the Holly Medal at the recent annual meeting of the American Society of Mechanical Engineers in New York City. This medal was awarded Dr. Moss for his many contributions to the development and application of turbo-superchargers to internal combustion engines.

STERLING ALLOYS, INC., Woburn, Mass., announces the appointment of H. V. BORDEAUX, 649 S. Olive St., Los Angeles, Calif., as engineering service representative for the state of California. The company also announces the opening of a Cincinnati office at 4 W. 7th St., with A. F. TENNEY and C. E. SMITH in charge.

RUDEL MACHINERY CO., INC., 532 Statler Bldg., Boston 16, Mass., has been appointed exclusive dealer in the New England territory for the engine, toolroom, manufacturing and Duomatic lathes produced by the LODGE & SHIPLEY MACHINE TOOL CO., Cincinnati, Ohio.

HAROLD J. RITTER, who resigned from the Norma-Hoffmann Bearings Corporation, Stamford, Conn., in June, 1944, has returned to the company and has been elected president, treasurer, and a member of the board of directors, succeeding O. P. WILSON, who has resigned.

GEORGE R. LARSEN has joined the Marion Electrical Instrument Co., Manchester, N. H., in the capacity of development engineer. During the war, Mr. Larsen was associated with the Signal Corps engineering laboratories at Fort Monmouth, N. J.

New Jersey

H. A. SMITH MACHINE CO., Hopewell, N. J., announces that the name of the company has been changed to ROCKWELL MACHINE CO. This company is a subsidiary of the ROCKWELL MFG. CO., Pittsburgh, Pa., and supplies precision machined parts to other subsidiaries and divisions of the parent company. There will be no change in personnel or policy. HERBERT S. ROCKWELL continues as director of operations at Hopewell.

COMMANDER GEORGE GELLHORN, who left the Worthington Pump and Machinery Corporation in 1942 for duty in the United States Navy, has been released to inactive status, and has resumed his position as export manager of the corporation, with offices at Harrison, N. J.

C. F. JOHNSON has joined the Watson-Stillman Co., Roselle, N. J., and will have charge of all engineering in the Forged Steel Fitting and the Bronze and Forged Steel Valve Divisions. He will also serve as a representative of the company in contacting the trade.

WILLIAM A. HANCOCK has been appointed sales manager of the Gaybex Corporation, Nutley, N. J., manufacturer of degreasing compounds, solvents, and cleaners, to succeed JOHN B. MOORE, who will assume the post of president and general manager of the company.

PAULA S. HODDESON has been appointed manager of advertising and sales promotion for the Walker-Turner Co., Inc., Plainfield, N. J. For two years Mrs. Hoddeson has been sales promotion manager of the company.

New York

FREDERICK G. SCHRANZ has established an office at 90 W. Broadway, New York City, as consulting engineer and manufacturers' representative. During the reconversion period, he will give special attention to the problems of manufacturers wishing to reconvert ordnance equipment to civilian production. He will also deal in various kinds of machinery and equipment and will design, engineer, and supervise installations, particularly those of hydraulic and power tools. For the last thirty years, Mr. Schranz had been affiliated with the old Southwark Foundry & Machine Co., which later became the Baldwin Southwark Division of the Baldwin Locomotive Works, Philadelphia, Pa. He served as vice-president.

JOSEPH M. JURAN, professor and chairman of the department of administrative engineering, New York University, was awarded the Worcester Reed Warner Medal at the recent annual meeting of the American Society of Mechanical Engineers in New York City, for his contributions to the solution of the problem of quality control in mass production. The medal is given for noteworthy contributions to engineering literature.

BARBER-COLMAN CO., Rockford, Ill., has established a direct sales office at 50 Church St., New York City, to handle sales and service of hobbing machines, sharpening machines, hobs, milling cutters, and reamers. The office will be under the direction of F. B. SQUIRES, of the recently dissolved Brewster-Squires Co., which for thirty years represented the Barber-Colman Co. in New York.

JOHN T. ROBBINS, formerly senior process engineer with the Curtiss-Wright Corporation, has joined the technical service staff of Peter A. Frasse & Co., Inc., 17 Grand St., New York 13, N. Y. Mr. Robbins will represent the company as metallurgical consultant, specializing in corrosion-resistant alloys.

COLONEL FRANK J. ATWOOD, for the last three and one-half years chief of the Rochester Ordnance District, Army Service Forces, has been named director of purchases for Remington Rand, Inc., Stamford, Conn., and its subsidiary companies. His headquarters will be at the company's New York offices, 315 Fourth Ave.

CORNER SIMON ASSOCIATES is a new firm organized to offer "tailored" engineering service to industry and management, covering product design and redesign. Offices have been established at 475 Fifth Ave., New York 17, N. Y. A. N. CORNER is executive engineer of the group, and LOUIS B. SIMON chief designer.

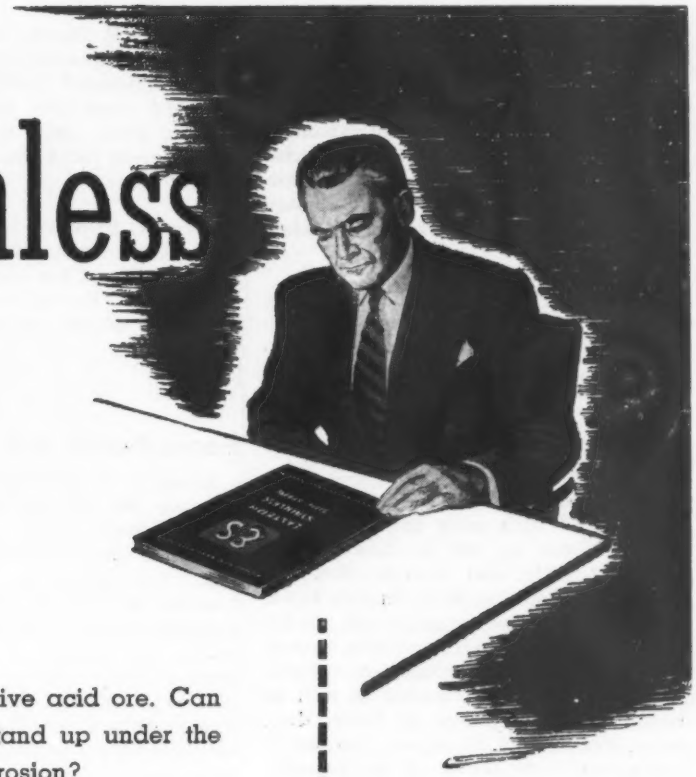
CRAWFORD, CALLAN & CO. 350 Madison Ave., New York 17, N. Y., have been appointed exclusive purchasing agents in the United States for S. A. C. SAAVEDRA BENARD, of Santiago, Chile, one of the largest importing companies in that country, which represents several machine tool concerns in the United States.

GEORGE K. BRADFIELD, JR., has been appointed assistant vice-president of the American Car and Foundry Co., 30 Church St., New York 8, N. Y. He was previously assistant director of research. In his new capacity, he will assist E. D. Campbell, vice-president in charge of engineering.

CURTISS-WRIGHT CORPORATION, 30 Rockefeller Plaza, New York 20, N. Y., announces the acquisition of the MARQUETTE METAL PRODUCTS CO., Cleveland, Ohio, manufacturer of precision parts and assemblies for the automotive and aviation industries.

H. B. AXTELL and V. A. CHERN will represent the PROGRESSIVE WELDER CO., 3050 E. Outer Drive, Detroit 12, Mich.,

which Stainless *shall I use?*



MINE CARS?

Our mine cars handle a moist abrasive acid ore. Can we get a Stainless Steel that will stand up under the abrasion, and also resist the acid corrosion?

HEAT TREATING EQUIPMENT?

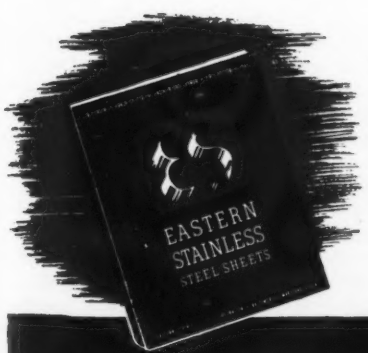
Our heat treating furnaces operate up to 1,500° F. Can we replace the hoods with Stainless? If so, which grade do you suggest?

CHEMICALS?

We are thinking of using Stainless Steel sheets for the lining of our dye vats. What grade and finish of Stainless Steel would you recommend?

MARINE HARDWARE?

Please send us your recommendation for the best grade of Stainless Steel for use in marine hardware, including rudders and fins.



Such questions on Stainless Steel selection are typical of questions which Eastern Stainless representatives answer every day. Eastern Stainless offers *all* the stainless grades you need for specialized applications of stainless steel sheet and plate. Consult Eastern on your selection problem.

Many of the answers are in the 96-page "Eastern Stainless Steel Sheet" handbook which, because of the great demand for copies, is now in its second printing. Write for your copy on your company letterhead.

JMLCO. E-A1

ask Eastern for the answer when Stainless is the question

EASTERN STAINLESS
STEEL CORPORATION
BALTIMORE 3, MARYLAND • Distributors' stock available in most areas
CHICAGO · CLEVELAND · DALLAS · DETROIT · LOS ANGELES · NEWARK · PHILADELPHIA

ES

in the eastern district. They have established offices at 15 Gramercy Park S., New York 3, N. Y.

FRANK T. CHRISTIAN has been appointed chief engineer of the Eclipse Machine Division of the Bendix Aviation Corporation, Elmira, N. Y. He has been connected with the engineering staff since 1929.

SUNDBERG & FERAR, Detroit 26, Mich., industrial designers, announce the opening of an eastern division at 1327 Lincoln Bldg., New York City.

Ohio

INDUSTRIAL RESEARCH & TOOL, INC., has been formed with main office and engineering room at 136 S. Ludlow St., Dayton 2, Ohio, and branch office and engineering room at 5946 Cermak Road, Cicero 50, Ill. The company will render a specialized engineering service, including consultation on production control, processing, and plant lay-out as well as designing and building of tools, dies, gages, and special machines. GEORGE D. LUDINGTON is president of the concern, W. W. ANDERSON, vice-president, and R. H. DEADY, secretary.

CAPTAIN A. G. HANDSCHUMACHER has been appointed sales engineer for Lear, Inc., Grand Rapids, Mich. Captain Handschumacher was discharged from the U. S. Army in November, having served as assistant to chief of Aeronautical Equipment Section, Procurement Division, at Wright Field. He will cover portions of Ohio, western Pennsylvania, Kentucky, and Indiana, and will make his headquarters at 114 N. College St., Yellow Springs, Ohio.

HYDRO-POWER, INC., Marion, Ohio, is constructing a new factory at Springfield, Ohio, for the production of hydraulic pumps, valves, and controls, and production is scheduled to start in February. The first unit of the new plant will have a floor space of 36,000 square feet. Plant design and construction contracts have been awarded to the Austin Co., Cleveland, Ohio.

INTERNATIONAL NICKEL CO., INC., 67 Wall St., New York 5, N. Y., announces the opening of the Cincinnati Technical Section of the company's Development and Research Division at 1715 Carew Tower, Cincinnati 2, Ohio. RICHARD B. KROPF, metallurgist and formerly district manager of the Copperweld Steel Co., at Hartford, Conn., will be in charge of the new section.

PETER V. ARMSTRONG, industrial designer, has been appointed chief of the new Consumer Goods Division of the Federal Machine & Welder Co., Warren, Ohio. Mr. Armstrong was formerly designer with the H. K. Ferguson Co. of Cleveland, and served as assistant chief engineer at the Euclid-Chase plant of the Chase Brass Co.

CHARLES E. HOWES has been appointed assistant manager of sales of the Steel Equipment Division, Berger Mfg. Division, Republic Steel Corporation, Canton, Ohio. Mr. Howes has served continuously with Berger for the last twenty years.

ROSS W. SWOGGER, former export manager of the Oster Mfg. Co., Cleveland, Ohio, will head his own export business in January. He will specialize on various types of machinery and industrial products.

Pennsylvania and Maryland

ABRASIVE CO., Philadelphia 37, Pa., announces that the company has changed its corporate name to the SIMONDS ABRASIVE CO., effective January 2. In 1927, the Abrasive Co., which was founded in 1892, was purchased by the Simonds Saw & Steel Co. of Fitchburg, Mass., and became a division of that organization. Simultaneously with the change in name, a new Simonds master trademark will be officially adopted, and will identify all products of the Simonds Abrasive Co., and of all branches of the Simonds Saw & Steel Co.

CHARLES H. JENNINGS, director of all welding research during the last nine years for the Westinghouse Electric Corporation, East Pittsburgh, Pa., has been made engineering manager of the welding department. JOHN H. BLANKENBUEHLER becomes manager of arc-welding apparatus, and E. HILL TURNOCK, JR., manager of arc-welding electrodes.

CLARENCE A. FEE has been made president and general manager of the Abrasive Co., Philadelphia, Pa. (now known as the SIMONDS ABRASIVE CO.). Mr. Fee takes the position formerly occupied by J. W. MCLEAN, who is retiring after serving in this capacity for sixteen years and having completed forty-four years' association with the company. Mr. Fee was previously Chicago branch manager of the Simonds Saw & Steel Co.

Clarence A. Fee, New President and General Manager of the Simonds Abrasive Co.

STANLEY BERG & CO., 521 Frick Bldg., Pittsburgh, Pa., have been appointed representatives of the LEHMANN MACHINE CO., St. Louis 3, Mo. Mr. Berg will make his headquarters at the Pittsburgh office, and will also maintain offices at 1026 Shoreham Bldg., Washington, D. C., where he has represented the Lehmann Machine Co. for several years.

HARRY A. DENNIS has been appointed sales representative in Erie, Pa., and vicinity, for the LUKENS STEEL CO. and subsidiaries, BY-PRODUCTS STEEL CORPORATION and LUKENWELD, INC., Coatesville, Pa. Mr. Dennis has been associated with the Lukens Steel Co. since 1939, for the last few years having been engaged in welding service engineering work.

W. B. PIERCE has been appointed head of the newly organized sales development department of the Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. Under Mr. Pierce's direction, a staff of engineers will assist manufacturers in the solution of problems involving applications of stainless steel and related alloys.

FLOYD ROSE, recently elected chairman of the board of the Firth-Sterling Steel Co., McKeesport, Pa., has established his headquarters at 1801-3 First National Bank Bldg., Pittsburgh, Pa. The Pittsburgh district office of the company has also been moved from the Oliver Building to that location.

CAPTAIN VINCENT H. GODFREY, who recently completed service in the U. S. Navy, has returned to the Page Steel and Wire Division of the American Chain & Cable Co., Inc., Bridgeport, Conn. Mr. Godfrey will occupy his former position as sales engineer, and will make his headquarters at Monessen, Pa.

A. R. ZAPP, carbide products manager of the Firth-Sterling Steel Co., McKeesport, Pa., has been awarded the annual medal of the Wire Association for the "most meritorious technical paper of the year written by a member of the Association on wire production and fabrication."

JOHN E. NIPAR has been appointed manager of sales and distribution for powdered metals and powder metallurgy parts by the Keystone Alloys Co., Derry, Pa. He was formerly assistant to the general manager.

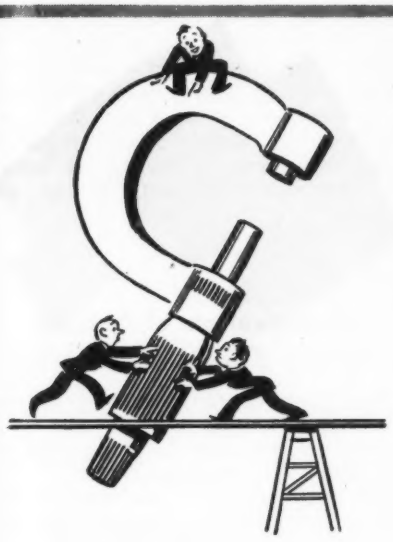
HARRY M. ELLSWORTH has been appointed manager of the industrial and technical advertising department of the Charles Blum Advertising Corporation, 1120 Spruce St., Philadelphia 7, Pa.

ALLEGHENY LUDLUM STEEL CORPORATION, Pittsburgh, Pa., announces that it

WHY IT PAYS TO USE THE *RIGHT* CUTTING OIL

LONGER TOOL LIFE

HIGHER PRODUCTION



CLOSER TOLERANCE

BETTER FINISH

BETTER CHIP SEPARATION

SHELL HAS THE *RIGHT* CUTTING OIL FOR EVERY APPLICATION

SHELL KNOWS THE IMPORTANCE of using the right oil for a particular cutting job. That is why Shell Lubrication Engineers balance the oil to fit the machine . . . the application . . . and the tool.

Make sure the machines in your plant get the benefit of all that's new in lubrication. Call the Shell Lubrication Engineer. Shell Oil Company, Incorporated, 50 West 50th Street, New York 20, New York; or 100 Bush Street, San Francisco 6, California.

SHELL

SHELL CUTTING OILS

FOR METAL CUTTING AND GRINDING

has acquired the ARNOLD ENGINEERING Co., Chicago, Ill., manufacturer of permanent magnets.

JOYCE MACHINE CO. announces the opening of its new plant at Jacksonville Road and Summit Ave., Hatboro, Pa.

BRIGGS FILTRATION CO., Bethesda, Md., has acquired the BRIGGS CLARIFIER CO. The officers who served with the old company will become officers of the new organization, and nearly all of the personnel of the old company have been retained.

Texas

CARBOLOY COMPANY, INC., Detroit, Mich., announces the organization of a new southwestern sales district, with A. J. ROD, sales engineer in charge of the Houston, Tex., branch, as district manager. The new district consists of territory in northern Texas, New Mexico, Oklahoma, Kansas, Louisana, Arkansas, Alabama, Mississippi, and western Florida.

JOSEPH W. SEARS, heretofore district sales engineer at the Dallas plant of the Link-Belt Co., has been appointed district sales manager, with headquarters at 711 Main St., Houston, Tex. STUART PENICK will succeed Mr. Sears as district sales engineer at Dallas.

EUGENE W. NORRIS, formerly director of technical service of the Aircraft Industries Association, Washington, D. C., has been appointed chief engineer of the Luscombe Airplane Corporation, Dallas, Tex.

Wisconsin

JOHN M. NEWMAN has been appointed general engineering supervisor of the Steel Mill, Machine Tool, Brakes, and Drum Controller Divisions of Cutler-Hammer, Inc., Milwaukee, Wis. Mr. Newman joined the company as a student engineer in 1933, upon graduating from the University of Minnesota.

INTERNATIONAL DETROLA CORPORATION, Elkhart, Ind., has sold its machine tool manufacturing interests to the GISHOLT MACHINE CO., Madison, Wis. The sale includes all of the Foster designs and drawings, patents, patterns, jigs and fixtures, trade names, and good will pertaining to Foster, Midland, and Libby turret lathes, Fastermatic lathes, and Super-finishing machines.

J. L. SINGLETON has been appointed manager for the sixty district offices of the sales department of the General Machinery Division, Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.

OTTO M. JENSEN, an executive for many years with the Peerless Machine Co., Racine, Wis., has been appointed works manager and vice-president in charge of engineering.

Obituaries

William D. Woolson

William D. Woolson, a pioneer in the machine tool industry, and treasurer of the Jones & Lamson Machine Co., Springfield, Vt., for fifty-six years, died suddenly on December 10 at the Springfield Hospital following a heart attack. Mr. Woolson was born in Springfield, Vt., on October 1, 1866. He attended the Springfield schools and graduated from St. Johnsbury Academy. In 1888, Mr.

William D. Woolson

Woolson went to Windsor, Vt., to join the Jones & Lamson Machine Co., which was at that time located in Windsor but which shortly after was moved to Springfield. Soon after joining the company, he acquired control of the concern, which he later shared equally with James Hartness. Mr. Woolson was a prime factor in the industrial development both of Springfield and Windsor, and encouraged many of the founders of the large machinery companies of those towns to start in business.

In addition to being treasurer and a director of the Jones & Lamson Machine Co., Mr. Woolson was vice-president of the Fellows Gear Shaper Co. and had been a director of that company since it was founded. He was also a past-president and director of Vermont Foundries, Inc., a director of the Boston & Maine Railroad, a vice-president and director of the First National Bank of Springfield, and a member of the American Society of Mechanical Engineers.

Mr. Woolson was esteemed by all who came in contact with him. He gave continual encouragement and inspiration to all of his associates. His passing is deeply regretted by all who knew him.

Alan Estes Flowers

Dr. Alan Estes Flowers, for more than twenty years head of the research and development department of the De Laval Separator Co., New York City, died on December 3 in the Vassar Hospital at Poughkeepsie, N. Y., after a few weeks' illness, aged sixty-nine years. Dr. Flowers was graduated from Cornell University in 1902. He received his master's degree in engineering in 1914 and his Ph.D. in 1915. In his earlier business life, he was connected successively with the Westinghouse Electric & Mfg. Co., the General Electric Co., the Columbus Electric Light & Power Co., and other concerns. He was also well known as a teacher, and served for five years as professor of electrical engineering at Ohio State University. A captain during the first World War, Dr. Flowers resumed his industrial work in 1919, and joined the De Laval organization in 1923. He was an inventor, author, and authority on many subjects. Dr. Flowers was highly regarded in engineering circles, and was a member of several societies, including the American Institute of Electrical Engineers, the American Society for Testing Materials, the American Society for Metals, the American Physical Society, and others.

* * *

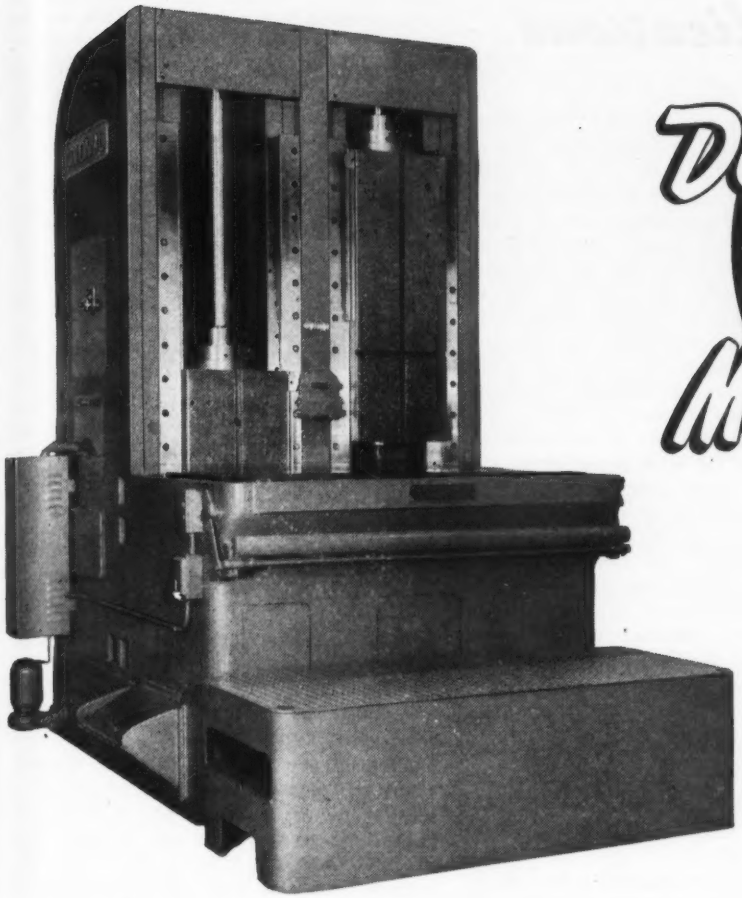
Preservation of Surplus Equipment

The "canning" of valuable war surplus materials, running all the way from heavy machine tools to delicate instruments and electrical apparatus, in aluminum containers is being done by the Glenn L. Martin Co., aircraft manufacturer, Baltimore, Md. Some of these aluminum containers "breathe" through a drying agent, and others are hermetically sealed. Tests indicate that by using aluminum in this manner, all kinds of manufactured articles and materials can be stored outdoors for many years without rust, corrosion, or deterioration.

By eliminating the necessity for warehousing, this development has solved one of the important problems confronting those having to do with the storage of surplus war materials, permitting them to be stored as "canned" materials in the open. By using such methods, it is believed that a tremendous quantity of equipment can be saved for future use.

* * *

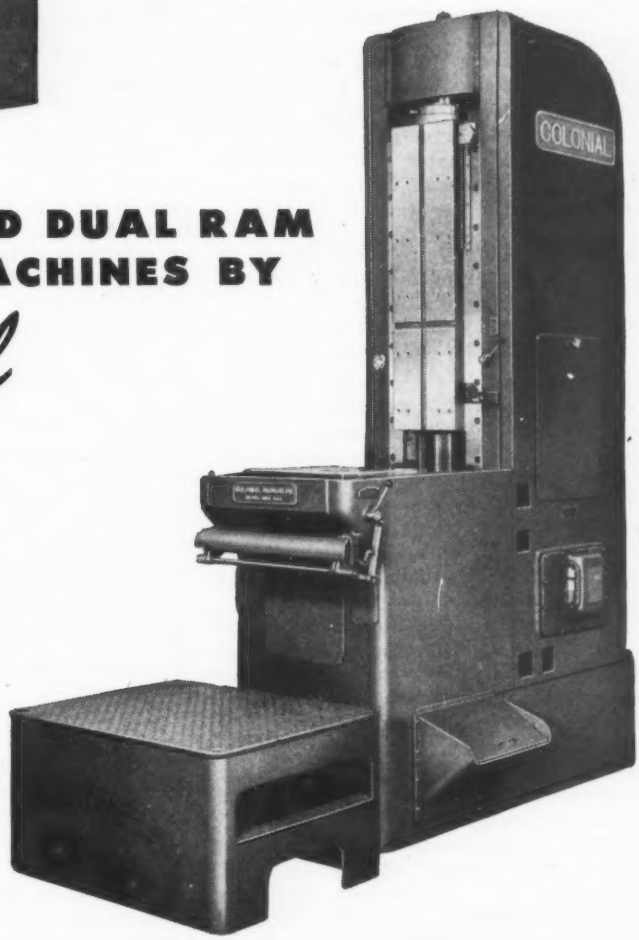
The complete philosophy of economics may be summarized in nine words: "There ain't no such thing as a free lunch." This the early settlers of this continent knew. This the pioneers who built America recognized; but the present generation has been taught a different doctrine, and by this new doctrine the sound foundation laid by the men who made America is being undermined.



Designed to Cut TODAY'S Machining Costs

At Left: Dual ram machine without tooling.

Below: Typical single ram type.



THE IMPROVED SINGLE AND DUAL RAM SURFACE BROACHING MACHINES BY *Colonial*

Even before the war, Colonial Hydraulic Single and Dual ram surface broaching machines had become the leaders in their field—mass production machining of outside surfaces at the lowest cost per piece.

Excess capacity for heavy duty jobs, maximum freedom from service trouble in continuous operation, rigidity to prevent deflection and maintain accuracy, provision for shuttling or other forms of automatic retracting loading tables, speed adjustable to meet the specific need for any given job, dual safety controls plus emergency knee-bar stop. These are just a few of the features built into every Colonial Single and Dual Ram Machine, whether they be of light tonnage with *minimum* stroke or heavy duty with *maximum* 66" stroke.

colonial BROACH COMPANY
DETROIT 13, U.S.A.

Broaches Broaching Machines - Broaching Equipment

New Books and Publications

BALL AND ROLLER BEARING ENGINEERING. By Dr. Arvid Palmgren. 270 pages, 7 by 10 inches. Published by S K F Industries, Inc., Philadelphia, Pa.

This book has been prepared to serve as a fundamental text on all phases of bearing applications in industry. The first chapter discusses common bearing types—both radial and thrust bearings—and gives data on dimensional proportions, running accuracy, and tolerances for each type. The second chapter, entitled "Forces and Motions in Bearings," is devoted to theory and calculations on such subjects as the nature of rolling resistance, friction torque, friction coefficients, stresses and deformations, load distribution, motion, and inertia. Other chapters deal with the carrying capacity of ball and roller bearings; bearing selection; design of bearing applications; mounting and dismounting; lubrication and maintenance; and bearing failures. The final chapter is made up of tables, conversion values, and a description of symbols and abbreviations.

First copies of the book will be sent to the heads of leading corporations, technical schools and colleges, and libraries in the principal cities of the United States. Later editions will be sold at cost to students and others interested in bearing studies.

AMERICAN MACHINISTS' HANDBOOK. By Fred H. Colvin and Frank A. Stanley. 1546 pages, 4 by 6¾ inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. Price, $5.

This is the eighth revised edition of a handbook devoted primarily to machine shop practice. It contains data, methods, and definitions for apprentices, machinists, toolmakers, draftsmen, designers, foremen, superintendents, and all others connected with shop and drafting-room practice in the metal-working and allied industries. The new edition has been considerably expanded and includes many new tables of standards and new material such as thread lobes for screw machine cams, knurling tools for automatics, a new method for calculating circular form tools, and practical points for threading operations on automatics. The punch press tools sections contains an important analysis of equipment used for cutting and forming aircraft sheet-metal work and other punch press data, including tonnage capacity, proposed standard sizes for aircraft tubing, data on bending radii, etc. In the milling section, the latest information has been added on hyper-milling practice.

THE AUTOMOTIVE CHASSIS (Without Power Plant). By P. M. Heldt. 583 pages, 5½ by 8¼ inches. Published by P. M. Heldt, Nyack 9, N. Y. Price, $6.

This book is the final one in a series on automotive engineering subjects which includes three other volumes. Like the others, it is intended both as a handbook for engineers and as a textbook for use in engineering courses. The book deals with the various parts of the automotive chassis, with the exception of the power plant. It discusses the functions of the parts, their theory, the materials of which they are made, and their design. Production processes are not covered, except in a few cases where special methods of recent origin have been applied with superior results. Rules for the proportioning of parts are given in almost every chapter, and in quite a few of the chapters design formulas expressing the operating characteristics of the parts are developed. The parts considered include frames, springs, axles, wheels, tires, drives, steering gears, brakes, universal joints, and differential gears.

A.S.M.E. MECHANICAL CATALOG AND DIRECTORY (1946). 822 pages, 8½ by 11½ inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

This well-known catalogue and directory of industrial equipment and materials is now in the thirty-fifth year of its publication. It contains a collection of catalogue data covering nearly 500 pages, which describes over three thousand items used by industry in manufacturing products and in maintaining its plants. The catalogue material is arranged in alphabetical order according to the name of the manufacturer. The directory, covering about 300 pages, contains a complete list of equipment, machinery, and supplies needed by the mechanical engineer, classified according to products, and completely cross-indexed. There is also a section containing an alphabetical list of trade names of products made by the firms listed. A sixteen-page insert contains information about A.S.M.E. codes, standards, periodicals, and other publications of the Society.

INTRODUCTION TO MAGNESIUM AND ITS ALLOYS. By John Alico. 183 pages, 6 by 9½ inches. Published by the Ziff-Davis Publishing Co., 185 N. Wabash Ave., Chicago 1, Ill. Price, $5.00.

As stated by the author in the foreword to this book, the need for an extensive American survey of available information on magnesium has long existed. The present volume has been prepared to answer this need, and should be of value both to metallurgical students, as well as to those concerned with the practical aspects of the fabrication and use of metals. It is pointed out that the magnesium industry has grown more than a hundredfold during the last four years, much of this growth being due, of course, to the impetus of the war production effort. The book covers the fundamentals of production and fabrication, including casting, forming, rolling, extruding, machining, and heat-treating.

PLASTICS. By J. H. DuBois. 447 pages, 5½ by 8¼ inches. Published by the American Technical Society, Drexel Ave. at 58th St., Chicago 37, Ill. Price, $4.

This is the third revised and enlarged edition of a book on plastics, written to serve as a text-book for students and a reference handbook for designers and users of plastic materials and products. The book contains basic information on plastics—their history, origin, and raw material sources; physical, chemical, and electrical properties and limitations; methods of fabrication; and data on design. A new section has been added to this edition incorporating the latest developments in the plastic field.

LESSONS IN ARC WELDING. 176 pages, 5½ by 8½ inches. Published by the Lincoln Electric Co., Cleveland 1, Ohio. Price, 50 cents in U.S.A.; 75 cents elsewhere.

This is the second edition (seventh printing) of a book containing sixty-one lessons in arc welding, which form the basis of instruction in the Lincoln Arc Welding School. The lessons are designed to assist both new and experienced welders, presenting complete instructions in all phases of arc welding. The book has not been completely revised but some new material has been added.

QUALITY CONTROL CHART TECHNIQUE WHEN MANUFACTURING TO A SPECIFICATION. By B. P. Dudding and W. J. Jennett. 74 pages, 5½ by 8½ inches. Distributed in the United States by the Gryphon Press, 301 S. Court House Road, Arlington, Va., by arrangement with General Electric Co., Ltd., England. Price, $1.

AN ANALYSIS OF THE MOTION OF A RIGID BODY. By Edward W. Suppiger. 60 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill., as Bulletin No. 353 of the Engineering Experiment Station. Price, 75 cents.

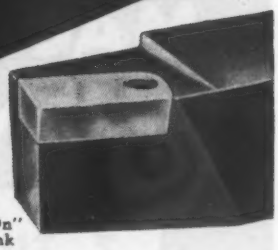
EVALUATION OF EFFECTS OF TORSIONAL VIBRATION. 576 pages, 8½ by 11 inches. Published by the Society of Automotive Engineers, 29 W. 39th St., New York 18, N. Y. Price to members, $5; to non-members, $10.

MANUAL OF PROCEDURE UNDER GOVERNMENT CONTRACTS. 88 pages, 5 by 8 inches. Published by the Fidelity & Deposit Co. of Maryland, Baltimore, Md. The book is obtainable from the publisher free of charge.

PRACTICAL DESIGN OF WELDED STEEL STRUCTURES. By H. M. Priest. 150 pages. Published by the American Welding Society, 33 W. 39th St., New York 18, N. Y. Price, $1.

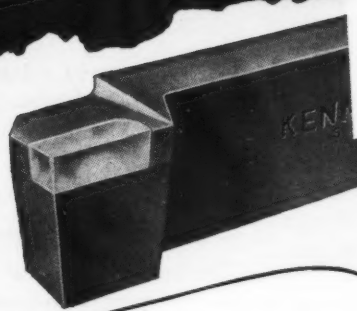
Here's What KENNAMETAL HAS DONE

STYLE 11HD
with "Clamped-On"
Kennametal blank



STYLE 11
with "Screwed-On"
Kennametal blank

that other cutting tools COULD NOT DO!



STYLE 1

on Sandy Iron Castings

Turned cast iron piston trunks—21½" diameter x 45" long—high in silicon, manganese, and carbon; very sandy surface; chilled around port holes. Showed practically no wear after machining three complete castings. This was Kennametal's *new* and *improved* tungsten carbide Grade K6.

Other makes were unable to take shock of interruptions, or withstand the highly abrasive cutting—could not complete one casting.

on Tough, Aluminum Bronze

Rough turned scaly Ampco metal bar stock—6" diameter x 14" long—continuously for 8 days. After turning 224 pieces (equivalent to 85 miles of lineal cutting) Kennametal tool did not need regrinding.

With other tools only one-fourth as many pieces could be machined before resharpening was needed.

on Chrome Nickel Steel

Rough turned very scaly chrome nickel forging—2' diameter x 10' long—in 30% less time, and with triple the tool life obtained from other tools, which could not stand up under the plunge cut through scale.

on Monel Metal

Bored 4½" hole in 6' long solid monel metal forging, to accurate size, in 32 minutes. HSS tool required 10 hours; sometimes produced up to .040" taper, due to wear, which required reboring.

on 14% Manganese Steel

Successfully rough and finish bored and turned huge casting. (High manganese steel is usually ground rather than machined because it hardens under cutting tool pressure.)

on "Everyday" Jobs, Too

The tool that takes tough jobs in stride is the one to use on routine production runs where overall cost-per-piece is the important factor. This is conclusively proved by official reports covering consumption of cemented carbides used during the war for machining 105mm shells:

- Where cemented carbide tools other than Kennametal were used, average carbide consumption per shell produced was approximately 3 *calculated grams.*
- In typical plants using Kennametal exclusively, average consumption per shell was *only* ½ *gram.*

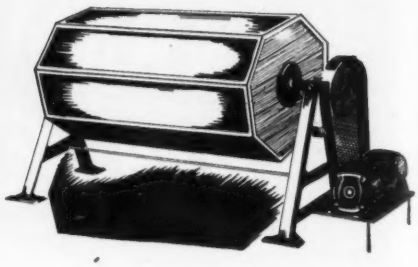
In other words—Kennametal Tools were up to 6 times as serviceable—a fact of utmost significance to all who must now manufacture post-war products—*economically.*

KENNAMETAL
SUPERIOR CEMENTED CARBIDES
KENNAMETAL *Inc.*, LATROBE, PA.

MACHINING DATA ON PLASTICS

7. TUMBLE POLISHING

(PART TWO OF TWO PARTS ON TUMBLING)



This is the seventh in a series of messages designed to better your knowledge about the machining and finishing of parts molded of phenolics—the most versatile of all plastics: the type of plastics which Durez has specialized in producing for the past quarter century.

As a general rule, molded Durez parts have a brilliant, lustrous finish on completion of the cure. However, requirements sometimes call for an even finer finish than that obtainable from the mold surface. In this latter instance, it becomes necessary to polish the parts on buffing wheels or in tumbling barrels. On large parts, the wheel method should be employed. On small parts, the tumbling method can be used to excellent advantage from the standpoint of economy and simplicity.

Recommended Procedure

When greater gloss or lustre is required on small parts such as buttons and closures, a method called "coloring" is employed. This procedure is as follows. In a hardwood tumbling barrel, similar to the one illustrated, are placed wooden shoe pegs or sawdust particles which have been saturated with a preparation of carnauba or paraffin wax dissolved in hot turpentine (in some cases Fullers' earth is also added). The wooden pegs or sawdust particles are then tumbled until a satisfactory coating of the wax preparation has been obtained. After this has been accomplished, the barrel is loaded to about 80% capacity with equal amounts by volume of molded parts and prepared pegs or sawdust. Be careful of using too small a charge as it may cause overheating and wax separation from the pegs. This usually results in an inferior polish.

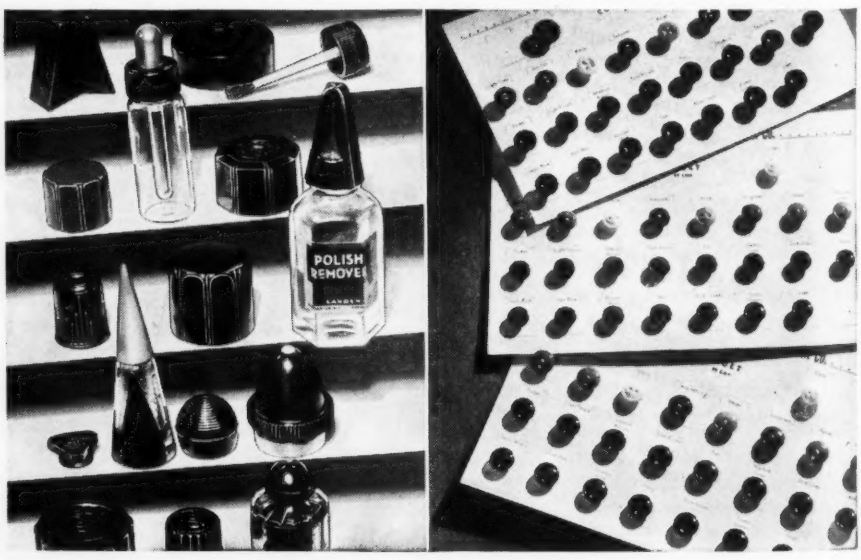
Time Element

Recommended speeds for tumble polishing range from 15 to 30 r. p. m. The time required depends entirely upon conditions such as type of wax used, type of material tumbled, and various other factors. Normally, about 6 hours tumbling time is required to obtain a lustrous finish on a molded Durez phenolic part.

Expert Assistance Available

The benefits of the vast experience which Durez technicians have acquired during the past quarter century are available at all times towards furthering your progress in the machining and finishing of phenolic plastics. Durez Plastics & Chemicals, Inc., 5813 Walck Road, North Tonawanda, N. Y.

The lustrous finishes of these molded Durez closures and buttons are the result of tumble polishing.



DUREZ

PHENOLIC RESINS

MOLDING COMPOUNDS

INDUSTRIAL RESINS

OIL SOLUBLE RESINS

PLASTICS THAT FIT THE JOB

Coming Events

JANUARY 7-11—PLASTICS EXHIBIT and annual meeting of the SOCIETY OF PLASTIC ENGINEERS in Detroit, Mich. Exhibit will be held in Convention Hall and meeting in the Horace H. Rackham Educational Memorial, 100 Farnsworth Ave. Further information can be obtained from Fred Conley, chairman of the publicity committee, 510 Stephenson Bldg., Detroit 2, Mich.

JANUARY 7-11—Annual meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS and Engineering Display at the Book-Cadillac Hotel, Detroit, Mich. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

FEBRUARY 1-2—Meeting of the LOW-PRESSURE INDUSTRIES DIVISON of the SOCIETY OF THE PLASTICS INDUSTRY, INC., at Edgewater Beach Hotel, Chicago, Ill. For further information, address the Society of the Plastics Industry, Inc., 295 Madison Ave., New York 17, N. Y.

FEBRUARY 4-7 — National meeting of the AMERICAN WELDING SOCIETY in Cleveland, Ohio; headquarters, Hotel Cleveland. Secretary, Miss M. M. Kelly, 33 W. 39th St., New York City.

FEBRUARY 4-8—METAL CONGRESS AND TWENTY-SEVENTH NATIONAL METAL EXPOSITION at the Public Auditorium, Cleveland, Ohio. Also annual convention of the AMERICAN SOCIETY FOR METALS in Cleveland; headquarters, Hotel Statler. National secretary, 7301 Euclid Ave., Cleveland 3, Ohio.

FEBRUARY 4-8—National meeting of the IRON AND STEEL and INSTITUTE OF METALS DIVISIONS OF THE AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS in Cleveland, Ohio; headquarters, Statler Hotel. Assistant secretary, Frank Sisco, 29 W. 39th St., New York 18, N. Y.

FEBRUARY 25 - MARCH 2 — Twentieth Exposition of Chemical Industries at Grand Central Palace, New York City. For further information, address Exposition of Chemical Industries, Grand Central Palace, New York 17, N. Y.

MARCH 28-29—AMERICAN GAS ASSOCIATION CONFERENCE ON INDUSTRIAL AND COMMERCIAL GAS at the Commodore Perry Hotel, Toledo, Ohio. For further information, address American Gas Association, 420 Lexington Ave., New York 17, N. Y.

APRIL 2-5—PACKAGING EXPOSITION in the Public Auditorium, Atlantic City, N. J., under the auspices of the American Management Association. Further information can be obtained from the American Management Association, 330 W. 42nd St., New York City.

APRIL 3-5—National Aeronautical meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Hotel New Yorker, New York City. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

APRIL 8-12 — Annual meeting of the AMERICAN SOCIETY OF TOOL ENGINEERS, and Exposition under the auspices of the Society, in Cleveland, Ohio. Executive secretary, Harry E. Conrad, 1666 Penobscott Bldg., Detroit, Mich.

JUNE 24-28—Forty-ninth annual meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS, to be held in Buffalo, N. Y., in conjunction with the seventh exhibit of testing apparatus and related equipment. For further information, address the American Society for Testing Materials, 260 S. Broad St., Philadelphia 2, Pa.

SEPTEMBER 16-20 — 1946 Exhibit and conference of the INSTRUMENT SOCIETY OF AMERICA in Pittsburgh, Pa.

* * *

Wider employment serves the national welfare—and should be a primary objective of all of us. Unfortunately, many people are too apt to place their own interests above the national welfare.—General Motors

Non-Electric Magnetic Separator

A powerful, compact, non-electric magnetic separator with a working surface made entirely of stainless steel has been developed by the Eriez Mfg. Co., Erie, Pa., for use on all types of equipment requiring magnetic installation. This magnetic unit can be built in any size to fit existing or new conveying equipment. It is constructed of magnetic Alnico alloy made under the General Electric Co.'s patents. Some of these magnets have been installed in connection with dies to eliminate the danger of foreign pieces of metal entering the dies and damaging them.

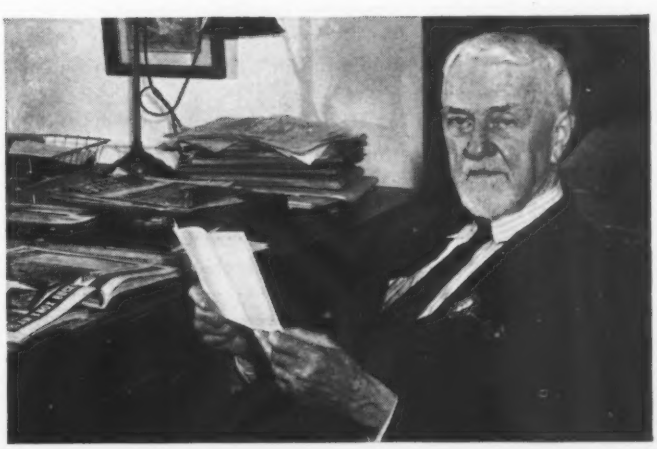
This equipment offers a simple and efficient means of preventing both large and small pieces of iron and steel from entering into materials or compounds where their presence would be objectionable. Numerous instances are quoted where these magnets have removed wrenches, bolts, nuts, and other parts of equipment that otherwise would have accidentally passed into manufacturing equipment. These magnetic separators need no wiring, since the power is furnished entirely by the Alnico steel magnets.

* * *

Barnaby Hinged-Shoe Bushing for Tool-Holders

An improved tool-holder bushing has been brought out by the Barnaby Mfg. & Tool Co., 70 Knowlton St., Bridgeport 8, Conn. This bushing has a clamping shoe fastened permanently to the body by a hinge pin, the shoe floating freely on the pin. This construction eliminates retaining rings. The shoe cannot become lost nor can the wrong shoe be used, and there is no slipping of bushing halves when clamped. These hinged-shoe bushings are available in sizes ranging from 1/2 to 1 inch in diameter, and are suitable for use in all types of drill-holders, tap-holders, knurl-holders, and floating holders. They can be furnished either blank or finished.

Charles Lukens Huston, first vice-president of the Lukens Steel Co., Coatesville, Pa., rounded out in December seventy years of service with the company, which was established by his forebears, and in which five generations of his family have participated. Mr. Huston entered the employ of the Lukens Rolling Mill, now the Lukens Steel Co., in December, 1875, as a clerk at a weekly wage of $8. In 1879, he was placed in charge of the puddling mill, and in 1882 took over the management of all plants. He continued in charge of operations until 1925, since which time he has acted in a consulting capacity. Mr. Huston still comes to his office regularly every day.



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